

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

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**SECTION C - DESCRIPTION/SPECIFICATION/WORK STATEMENT**

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**STATEMENT OF WORK (GRC 52.211-106) (JULY 2014)**

**C.1 INTRODUCTION**

The NASA Glenn Research Center (GRC) encompasses of two sites: Lewis Field (LF) in Cleveland, Ohio and Plum Brook Station (PBS) in Sandusky, Ohio. This majority of the services required under this solicitation are for the GRC LF campus, but there are selected services required at GRC PBS as well.

GRC LF is comprised of 298 acres and includes 79 active buildings and 92 structures and systems (electrical substations, cooling towers, underground utilities, etc.). The buildings on the Center enclose a total of 2.25 million square feet of floor area which consists of Propulsion & Aerospace R&D Test Facilities (63%), Administrative Offices (27%) and Warehouse/Storage/Shop Area (10%). Currently, 70% of these facilities are 60 years old or greater.

GRC PBS is comprised of 6,377 acres and includes 130 active buildings and 39 structures and systems. The buildings on the Center enclose a total of 584,000 square feet of floor area which consists of Propulsion and Aerospace R&D Test Facilities (42%), Administrative Offices (14%) and Warehouse/Storage/Shop Area (44%).

This solicitation is for a cost plus, incentive fee contract for: (1) maintenance, repair & operations of the GRC LF Central Process Systems, (2) maintenance and repair of the GRC LF & PBS Cryogenic Systems, (3) maintenance and repair of the GRC LF High Voltage Electrical Substation Controls, and (4) certification services for the GRC LF & PBS Pressurized Vessels & Systems. Historic workload data for these required services is provided in Attachment J-X.

This Statement of Work (SOW) is structured to show overall contract management and business requirements in Chapters C.1 through C.XX, and the technical requirements in Chapters C.XX through C.XX. Attachment J-X, GRC Lewis Field Real Property List and Attachment J-X, GRC Plum Brook Station Real Property List which describes the buildings, structures and systems that will require services offered under contract.

**C.2 SCOPE OF WORK OVERVIEW**

**C-2.1 General.** The Contractor shall furnish all management, labor, supervision, tools, materials, equipment, and transportation necessary to address all elements outlined within this SOW.

C-2.1.1 Contractors shall utilize the latest version of NASA Policy Requirement NPR 8831.2 *Facilities Maintenance and Operations Management* as an advisory document for all maintenance and repair services identified in this SOW.

C-2.1.2 The Contractor's Pressurized Vessels and Systems certification services shall conform to the latest versions of NASA Policy Directive NPD 8710.5 *Policy for Pressure Vessels and Pressurized*

# **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

*Systems and NASA Standard NASA-STD-8719.17 NASA Requirements for Ground-Based Pressure Vessels & Pressurized Systems (PVS).*

This contract consists of a Base Work Scope and an Indefinite Delivery, Indefinite Quantity (IDIQ) Work Scope.

**C-2.2 Base Work Scope.** The Base Work Scope for this contract consists of the following:

- C-2.2.1 Contract Management (including program management, business functions, work control functions, safety, health & environmental functions, etc.) for both the Base & IDIQ Work Scopes.
- C-2.2.2 Minor Repairs, Maintenance and operations of the GRC LF Central Process Systems.
- C-2.2.3 Minor Repairs, Maintenance and design modifications for the GRC LF & PBS Cryogenic Systems.
- C-2.2.4 Minor Repairs, Maintenance of the GRC LF High Voltage Electrical System Controls.
- C-2.2.5 Certification services for the GRC LF & PBS Pressurized Vessels & Systems.
- C-2.2.6 Minor Design modifications and analysis for the GRC LF & PBS Pressurized Vessels & Systems.
- C-2.2.7 All technical staff to support the functions listed above.

**C-2.3 IDIQ Work Scope.** The IDIQ Work Scope for this contract consists of the following:

- C-2.2.1 Major Repairs and Upgrades to the GRC LF Central Process Systems.
- C-2.2.2 Major Repairs and design for the GRC LF & PBS Cryogenic Systems.
- C-2.2.3 Major Repairs and Upgrades to the GRC LF High Voltage Electrical System Controls systems.
- C-2.2.4 Major finite element analysis, flexibility analysis and design for hardware modifications for the GRC LF & PBS Pressurized Vessels & Systems.
- C-2.2.5 All technical staff to support the functions listed above.

**C-2.4 Central Process Systems (CPS) Operations, Repair & Maintenance.** The GRC LF Central Process Systems (CPS) consists of a series of critical research utilities that support aerospace ground test facilities throughout the campus. Many of these aerospace facilities conduct “real time” testing of air-breathing engines, rocket engine components and other related systems. To replicate the conditions encountered in flight such as high speed and/or high altitudes, GRC utilizes very large centralized compressed air system (called the Combustion Air System) and a large centralized vacuum system (called the Altitude Exhaust System). In addition, these systems require a multitude of subsystems to heat, cool, or dry air as required for specific tests.

Most of the GRC LF CPS equipment and subsystems are located in the Central Air Equipment Building No. 64 or in the Engine Research Building (ERB) Complex which consists of Building Nos. 5, 23, 37 and 38. Large overhead piping delivers the Combustion Air or Altitude Exhaust to various aerospace ground test facilities located throughout the Central Campus of GRC LF. Control of equipment and dispatching services are provided from control rooms located in B143, B64 and B5.

This Contract shall provide continuous operations during pre-start, run, and shut down for research activities in accordance with the published research schedules referenced herein.

The CPS consists of the following systems and subsystems:

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

**C-2.4.1 Combustion Air (CA) System.** To simulate speed, large electric motor driven compressors produce pressurized air ranging from 40 to 1250 psig. Typically, air at ambient conditions is gradually raised in pressure, using staged compressor systems, in increments from 40 psig, 150 psig, 450 psig and 1250 psig. Each stage includes equipment to cool, heat or dry the air as required for specific test conditions. Maintenance, repair and upgrade implementation of the Combustion Air System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

**C-2.4.2 Altitude Exhaust System.** To simulate high altitude conditions, large electric motor-driven compressors (typically called “exhausters”) create conditions that simulate altitudes up to 90,000 feet above sea level. Much like the Combustion Air System, the Altitude Exhaust System is staged, and each stage requires subsystems to cool and dry the air. Maintenance, repair and upgrade implementation of the Exhaust System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

**C-2.4.3 Service Air (SA) .** The Service Air System provides a center-wide continuous supply of clean, dry 125 psig compressed air. Three Ingersoll-Rand PRE compressors (SA20, SA21 and SA22) located in the basement of the Engine Research Building (Building 5) serve as a primary source of compressed air. A fourth identical compressor (SA23) located in the Special Projects Laboratory (Building 24) serves as an alternate source to supplement the system when demand is high. A new fifth Centrifugal compressor (SA24) will be installed in 2015 which will be located in Central Air Equipment Building (Building 64) will serve as an alternate source to supplement the system when demand is high. Once SA24 is operational, SA23 will be decommissioned. Maintenance, repair and upgrade implementation of the Service Air System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

**C-2.4.4 Centralized Cooling Tower (CT) Water System.** Cooling of CPS equipment and systems is accomplished using water from four (4) large cooling towers located on the Central Campus. Specifically, the Centralized Cooling Tower Water System includes Cooling Tower No. 1 (Property No. 10), Cooling Tower No. 3 (Property No. 70), Cooling Tower No. 4 (Property No. 82), Cooling Tower No. 5 (Property No. 93), and Cooling Tower No. 6 (Property No. 126). Maintenance, repair and upgrade implementation of the Cooling Tower System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

**C-2.4.5 Variable Frequency (VF) Electrical Power System.** The Variable Frequency Electrical Power System at the Engine Research Building West Wing (Building 23 basement) is an electrical power supply that is connected to various test cells (W1, W7, W8, CE18). The output frequency is adjustable from 10 to 120 cycles per second (Hz) with voltage proportional to frequency (54 V/Hz). It can deliver or absorb power to the full rating of the equipment. Complete flexibility of set-up and operation is obtained through paralleling and switching of converter combinations to the ring bus switchgear. Maintenance, repair and upgrade implementation of the Variable Frequency System and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

**C-2.4.6 Central Process System Distributed Control (CPSDC).** The Central Process System Distributed Control uses remote processors and programmable logic controllers communicating via thirteen miles of coaxial data highway cable to operator workstations in Buildings 143, 64, 23 and 5. The remote processors and programmable logic controllers (with over 14,000 I/O points) are used for control and data acquisition of equipment in the areas of Electrical Power Dispatch, Central Air Dispatch, Engine Research Building (ERB) and Central Air Equipment Building (CAEB) and The

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

Variable Frequency Power facility (VF). This equipment includes Compressors, Exhausters, Dehydrators, Chillers, Cooling Towers, Valves, Substations, Uninterruptible Power Systems (UPS), Electrical Motors, and Generators for backup power and variable frequency power generation. The CPSDC Data Archive system provides historical data for all 14,000 data points. Data playback format can be in graphic trend or operator process screen playback. All data from Feb. 7, 1999 is available on line for recall and playback. Standard time resolution of data is one second but 100 msec playback is available for particular Sequence of Event information. Maintenance, repair and upgrade implementation of the Control System are part of the work scope of this contract.

### **C-2.4.7 Central Air Distribution (CAD) System**

The CAD system encompasses five CPS services; Combustion Air, Service Air, Refrigerated Air, Altitude Exhaust and Atmospheric Exhaust. The distribution system routes airflows at different pressures to the various test facilities located within Lewis Field and is comprised of over 9 miles of piping, 730 remotely controlled valves, and a multitude pressure relief and monitoring devices. Historically operations of the CAD systems were performed within the Central Control Building. The Contractor shall be responsible for providing CAD systems dispatching operations; operations consist of dealing with the various researchers to determine the daily equipment requirements and schedule, directing equipment operators in setting up equipment and systems configurations, and routing the air services to the customers. The maintenance of these systems is part of this contract as well.

**C-2.5 Cryogenic Systems.** The Cryogenic Systems include various high pressure gases and cryogenic liquids including: air, methane, nitrogen, hydrogen, oxygen, helium and argon mediums. These mediums are delivered to GRC LF & PBS by outside vendors and stored in stationary or mobile pressure vessels and cryogenic Dewars. Cryogenics may be used in the liquid form or transformed into high pressure gases through vaporizers\cryo pumps for research applications. Mobile equipment includes approximately: 32 Tube Trailers, 19 Dewar and 6 Liquid Vaporizers. Stationary equipment include approximately: 21 Dewars, 35 High Pressure Vessel locations, 22 mobile Liquid Vaporizer Connections, 28 Tube Trailer Connections, 38 Distributed Systems and 71 non-Distributed Systems. The scope of work for cryogenic systems includes maintenance, operations, and engineering.

**C-2.6 High Voltage Electrical Substation Control Maintenance & Repair.** High voltage electrical power for both institutional and research testing needs is supplied to GRC LF through four (4) 138 kV lines from First Energy to GRC Substation A, Property No. 200. This power is subsequently routed through underground concrete duct banks\* to twelve (12) additional Substations located throughout the Center. Maintenance, repair and upgrade implementation of the substation controls and the interface to the Central Process Systems Distributed Control (CPSDC) is part of the work scope of this contract.

**\*NOTE:** Above ground electrical power lines are routed on poles between Substation A and Substation N.

**C-2.7 Pressurized Vessels & Systems (PVS).** In addition to Central Process Systems, various gases and cryogenic liquids including nitrogen, hydrogen, oxygen, helium and argon are delivered to GRC LF & PBS by outside vendors and stored in pressure vessels and cryogenic dewars. Complex piping systems distribute these gases and cryogenic fluids to various test cells and research facilities. These pressure vessels and piping systems must be regularly certified to various National Consensus Codes and Standards (NCS) such as ASME Boiler and Pressure Vessel Code, ASME B31 series Piping Codes, NFPA fire codes, CGA guidelines, and API recommended practices. The certification process requires regular In-Service Inspection (ISI) of PVS by qualified personnel, engineering analysis to assess

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

remaining life, and formal documentation. A formal Pressure Systems Database (PSD) is be maintained. Associated repairs necessary to bring PVS into code compliance are also within the scope of this contract.

The GRC certification program includes roughly 1,400 systems (with over 30,000 associated components), 1,100 pressure vessels, 140 Dewars, 200 heat exchangers, 5,000 relief devices, and 2,200 Flex Hoses. These system convey over 50 different commodities such as air, cryogenics (LOX, LH2, LCH4, inerts), fuels, water, steam, Freon, and toxics (Ammonia, Hydrogen Chloride, Silane, Propane, Oxygen, Nitrous Oxide, etc.). Pressurized systems include wind tunnels, vacuum vessels, dryers, dehydrators, coolers, filters, separators and other components. Required inspection, certification, maintenance, and repair of these vessels, piping and components are included in the scope of this contract.

In addition to PVS associated with research activities, the Contractor shall certify institutional systems at GRC LF & PBS as identified in Attachment J-XX.

Preliminary Draft

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-3. SPECIFIC ACTIVITIES NOT CONTAINED WITHIN THE SCOPE OF THIS CONTRACT**

**C-3.1. CPS Engineering.** The Contractor shall not be responsible for providing any CPS engineering; all CPS engineering will be provided by the Facilities Division. The Contractor shall be responsible for notifying the Facilities Division when they believe engineering services are required for troubleshooting. The Contractor shall notify the Facilities Division of any system or components upgrade or modification they believe needs to be implemented that will enhance the performance of the CPS.

**C-3.2. Institutional Responsibilities.** The Contractor is not responsible for institutional areas. The Contractor shall not correct institutional abnormalities but shall immediately report such abnormal conditions to the COR and Work Control Office. Such conditions would include, but not limited to, structural and cosmetic damage; leaking roofs; inoperable or backed up floor, toilet, and sink drains and plumbing; overfilled liquid reservoirs; leaking pipes; electrical or mechanical damage; fire or overheated equipment, area lighting, telephones, alarm systems, intercom systems and room temperatures.

**C-3.3. Electrical Power Dispatching Operations.** The maintenance and repair of substations and the underground cabling and the dispatching of electrical power throughout the Center is NOT part of the scope of work for this contract. The operation of breakers associated with the High Voltage Distribution Systems (ED) is also not part of this Contract.

**C-3.4. Software Modifications.** The Contractor shall not modify any software. The Contractor shall notify the COR of any required software changes.

**C-3.5. CT Fire Protection and CT Water Treatment.** CT Fire Protection and CT Water Treatment is NOT part of the scope of work for this contract.

**C-3.6. Fuel Services.** Fuel dispatching is NOT part of the scope of work for this contract.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C.4 GENERAL REQUIREMENTS, PRACTICES AND PROCEDURES**

**C.4.1. General.** The following are general GRC requirements, practices and procedures that apply to all aspects of the work specified in this SOW.

**C-4.2. Work Schedules.** The Contractor shall be fully cognizant of the NASA Research Facility Test/Central Process Systems Requirement Schedule in planning work activities. It is the contractor's responsibility to ensure the equipment is ready for operation to meet these research requirements. The Research Facility Test/Central Process Systems Requirement Schedule is published every Thursday by the Central Air Dispatchers and is normally available over the IDE network by 2:00 p.m. The schedule may be updated periodically throughout the week to reflect schedule changes. The Contractor shall develop a weekly manpower staffing chart per facility/discipline based on the schedule and based on looking at the efficiency and manpower loading.

**C-4.2.1. Task Order Work Schedules.** The Contractor shall provide to the COR a copy of any other work schedules (e.g. monthly, weekly) as requested in the Work Orders/Task Orders. The Contractor shall notify the COR of any revisions or deviations to the published schedules and provide a revised copy.

**C-4.2.2 System and Equipment Maintenance Shutdown (Annual Maintenance Shutdown) Work Schedule.** Annual Maintenance Shutdowns generally last at least two (2) weeks depending on research activities, construction of facility projects and other factors. Minor shutdowns may occur at any time during the year. The Contractor shall develop a schedule detailing all the activities the Contractor plans to accomplish during the Annual Maintenance Shutdown or other minor shutdowns. The schedule shall be submitted to the COR for review. The schedule shall be submitted to the COR no later than the sixty (60) calendar days before the start of the Annual Maintenance Shutdown, and no later than fourteen (14) calendar days before the start of minor shutdowns. The schedule shall be divided into sections and identified, by building or area location, by work category, OCMR, PM, PGM, PT&I, I&R, and so forth. As a minimum, the schedule shall indicate all work to be accomplished and completion dates. Deviation from the schedule is permissible as long as all work scheduled is completed before the end of the scheduled shutdown.

**C-4.3. Performance.** The Contractor's work performance shall comply with the approved and accepted standards of the industry, equipment manufacturers, applicable local, state, federal standards, and all applicable facility and safety codes.

**C-4.3.1. Workmanship.** Corrective repair and replacement work shall be carried to completion and include operational checks and cleanup of the equipment and job site. Replacement work shall match previous work in dimensions, finish, color, and design unless otherwise specified by the Government.

**C-4.3.2. Cleanliness.** During the execution of work tasks, debris shall not be allowed to accumulate on the jobsite or spread into adjacent areas. At the completion of the job, debris, excess material, and parts shall be cleaned up and removed from the job site. Waste shall be placed in the appropriate containers in compliance with GRC Waste Management standards. The Contractor shall be responsible to maintain good housekeeping in electrical and mechanical areas in buildings.

**C-4.4 Equipment Under Warranty.** New equipment, components, and parts installed by other contractors shall not be removed or replaced or deficiencies corrected while still under warranty of the manufacturer or the installer without prior approval of the COR. All defects in material or workmanship, defective parts, or improper installation and adjustments found by the Contractor shall be reported to the COR so that necessary action may be taken. Available warranty information will be furnished to the

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

Contractor by the COR or be indicated within the Maximo system (Contracts Module).

**C-4.5 Configuration Management.** The Contractor shall obtain Government approval prior to making configuration changes to any existing system. Any changes made to GRC infrastructure as a result of work performed through a Maximo work order shall be relayed to the COR for incorporation into the official Drawing Records, maintained by the Facilities Configuration Control Office. In addition, the Contractor shall conform to the following configuration management requirements:

**C-4.5.1.** For CPS, the Contractor shall be responsible for providing red-lined drawings that capture changes. The red-lined drawings shall be transferred to the COR.

**C-4.5.2.** For non-CPS, the Contractor shall be responsible for creating as-built drawings from red-lined drawings via Autocad that capture changes. The as-built drawings shall be transferred to ADEPT for signatures.

**C-4.5.3** If new Assets are added as a result of SR or ROI work, official Maximo asset numbers must be obtained from the COR. See Section C.9.5.a for further Asset information requirements.

**C-4.5.4 Pressure Systems Database.** The Contractor will be given access to the Pressure Systems Database (PSD) and will be charged with continually updating and maintaining accuracy of all data contained within. The PSD is web-based database operating on the Oracle platform. It is used to track Pressure Vessel and System data at both the component and system levels. Data maintained includes physical configuration data (component brand, make, model, size, and capacity information, etc.) as well as In-Service Inspection (ISI) status information. Maintaining an accurate PSD is considered a necessary and essential discipline of Configuration Management.

**C-4.6. Access To Government Drawings & Records.** The Contractor will have accesses to the roughly 120,000 facility record drawings managed by the GRC Configuration Control Office. This includes access to hard-copy stick files (located in Building No. 21) and access to the following database systems:

**C-4.6.1 Adept (Synergis Software, a Division of Synergis Technologies, Inc.).** The Contractor will be given read-only access to the GRC Adept system, which is used to help locate, manage, share, and control native AutoCAD documents throughout their lifecycle. Adept integrates with AutoCAD data files and any CAD-related support files. Many Adept folders also contain PDF versions of operations & maintenance manuals, data sheets, and project information. Adept has been active at GRC since 2007, and is the official repository of controlled documents for GRC Lewis Field and Plum Brook Station.

**C-4.6.2 Glenn Drawing Information System (GDIS).** The Contractor will be given access to GDIS, which is a web-based database used to track and search for drawings and drawing-related items. Unlike Adept, GDIS cannot display or control native AutoCAD files (DWG files). GDIS can display PDF files of drawings and of stored Facility Change Requests (FCRs).

**C.4.7. Area Clearance Process.** The Contractor shall utilize the GRC Area Clearance process when work requires the interruption of a utility or service. This process ensures that the work can be accomplished in a safe manner and that there is adequate notification of the timing, duration and nature of the impact to building occupants and/or facilities. The GRC Area Clearance Procedure is provided in Attachment J-10, General Library and the Area Clearance Form, NASA Standard Form C-978, is provided in Attachment J-9.



## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

**C.4.8. Interfaces With Government Personnel and Other Government Contractors.** The execution of the SOW will require this Contractor to interface with a wide variety of Government personnel and other Government contractor personnel. These interfaces are as follows:

**C.4.8.1 Contracting Officer (CO).** The CO is the only Government individual with the authority to enter into, administer, and/or terminate this contract and make related determinations and findings. The CO will be the Contractor's single POC for all invoices for completed work and changes to scope, schedule, or contract value. No other individual has the authority to make decisions on behalf of the Government regarding this contract.

**C.4.8.2 Contracting Officer's Representative and Alternate (COR/ACOR).** The COR acts as an advisor to the CO regarding technical, schedule, financial, and quality matters associated with the contract. The Contractor's Program Manager and Business Office personnel will have daily interactions with the COR regarding the status of on-going work and the financial aspects of the contract.

In the absence of the COR, the ACOR will assume the above duties.

**C.4.8.3 Technical Representatives (TR).** GRC's civil servant System Manager, Facility Manager or Facility Engineer responsible for Technical oversight of Contractor Performance. The Contractor's field technicians may have daily interactions with the TR on Technical issues.

**C.4.8.3.1 Systems Managers (SMs).** The SM is senior-level civil servant engineer who provides management and oversight for operations, maintenance, and for new installations of institutional facility systems and equipment. The SMs are considered to be subject matter experts of their respective systems. Specifically, the SM is responsible for:

- C.4.8.3.1.1 Defining equipment and system requirements
- C.4.8.3.1.2 Establishing operating policies and procedures
- C.4.8.3.1.3 Maintaining the system knowledge on system capability and capacity
- C.4.8.3.1.4 Maintaining configuration control

In addition, the SM is responsible for approving Area Clearances for system outages, Facility Change Requests (FCR), Operational Safety Permits, and Dig Permits.

**C.4.8.3.2 Facility Managers (FMs).** The FM is senior-level civil servant engineer who provides management and oversight for test facility systems and equipment. The FMs are considered to be subject matter experts of their respective facility.

**C.4.8.3.3 Facility Engineers (FEs).** The FE is engineer who provides engineering and oversight for test facility systems and equipment.

**C.4.8.5 Building Managers.** The GRC Building Manager is responsible for overseeing and communicating all building related issues which impact building occupants and stakeholders. These responsibilities include capturing and tracking building related issues and facilitating a resolution with the SMs, FOSs, and the Institutional Facilities Maintenance contractor. The goal of a Building Manager is to foster cooperative relationships with building occupants and to ensure that building services are adequately maintained. GRC has assigned a Building Manager for all of the properties at GRC Lewis Field.

## CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK

**C.4.8.6 Safety & Mission Assurance Organization.** The GRC Safety and Mission Assurance organization ensures that a safe, healthful, and protective environment is available for all GRC on-site personnel and contractors. This organization includes a Reliability and System Safety group, Occupational Health group (which includes the Chemical Management group), and an Operational Safety group.

The Contractor's Quality Assurance and Safety & Health personnel (see requirements in Section C.8.5) shall interface with the GRC organizations on a regular basis.

**C.4.8.7 Authority Having Jurisdiction (AHJ).** At GRC, the AHJ is the individual responsible for implementing the fire safety provisions of NPR 8715.3, NASA General Safety Program Requirements. The AHJ has been delegated the authority by the Center Director for approving all life safety and fire protection system installations, procedures, equipment selections, testing, and maintenance at both GRC Lewis Field and Plum Brook Station. In addition, the AHJ is authorized to enforce the provisions of the applicable fire and building codes and shall have the authority to render interpretations of these codes, to adopt policies, to establish procedures and regulations in order to clarify the application of its provisions.

**C.4.8.8 Pressure Systems Manager (PSM).** The PSM is responsible for implementing the pressure systems compliance program required under NPD 8710.5 and STD 8719.17. The PSM has been delegated the authority by the Center Director for approving pressure system installations, procedures, equipment selections, testing, and maintenance at both GRC Lewis Field and Plum Brook Station. PSM is charged with interpreting and assuring compliance with all applicable National Consensus Codes and Standards (NCS) such as ASME B31 series piping Code, ASME Boiler and Pressure Vessel Code, API Recommended Practices, CGA standards, etc. (see app J for full listing of applicable NCS). The PSM has authority to render interpretations of these codes, to adopt policies, to establish procedures and regulations in order to clarify the application of it NCS and agency policy provisions.

**C.4.8.9 Energy & Environmental Management Organization.** The GRC Energy & Environmental Management organization provides overall coordination and integration of the Center's energy and environmental efforts. This office is responsible for establishing energy and environmental metrics, in compliance with federal, state and local government regulations and mandates, and in alignment with Agency sustainability policies. The office oversees the planning and implementation of institutional initiatives to ensure synergy, environmental benefits and energy savings.

**C.4.8.10 Configuration Control Organization.** This organization has the responsibility to provide direction, management and assistance of facility drawings to GRC civil servant and contractor personnel. The GRC Configuration Control organization provides the following services:

- C.4.8.10.1 Facility Drawings Configuration Control
- C.4.8.10.2 Facility Drawings Reproduction Services
- C.4.8.10.3 Facility Engineering Drawings Retrieval & Assistance Program (FEDRAP)
- C.4.8.10.4 Glenn Drawing Information System (GDIS)
- C.4.8.10.5 Facilities Electronic Data Management System (FEDMS)
- C.4.8.10.6 Facilities Drawing Central Web Site (FDC)

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C.4.8.11 Waste Management and Disposal Contract.** GRC has an existing contract for the disposal of solid, liquid, and hazardous wastes. The Center's general goal is to divert collected recyclables and waste from the waste stream by collecting and redirecting materials to an appropriate recycling facility. Those waste materials that cannot be recycled are segregated and directed to the appropriate landfill. Waste management and disposal services are available from 7:00 a.m. to 4:30 p.m., Monday through Friday.

Solid waste is defined as all municipal waste, compostable, recyclable and non-recyclable, including paper, cardboard, aluminum cans, metal, glass, plastic, landscaping debris, wood, wood pallets, polystyrene, electronic waste, toner cartridges, asphalt (street sweepings) and other miscellaneous debris both inside containers and in the immediate vicinity of the containers. All solid waste, identified by the Government as recyclable, is recycled. All landfills and receivers of material (scrap metal, wood, plastic, and glass) are approved by the Energy and Environmental Management Office at GRC.

The Contractor shall work with the COR to utilize the existing contract for the disposal of solid, liquid, or hazardous wastes associated with this contract. This includes the handling and disposal of waste materials such as CFC refrigerants, PCBs, asbestos, lead, petroleum-based wastes, storm and sanitary effluent, storm water debris from structures, sediment, hydraulic fluids, and chemicals.

**C-4.8.12 Janitorial Contract.** GRC LF has a stand-alone janitorial contract for office trash pickup, restroom cleaning, floor cleaning, and other miscellaneous cleaning services that can be ordered on and IDIQ basis. These services will be furnished for all Government-furnished office space provided under this contract at no cost to the Contractor.

Janitorial services for other Government-Furnished Facilities (GFF) provided under this contract (e.g., shop space, material storage space, etc.) are not provided. In these instances, the Contractor shall provide housekeeping services to ensure these areas are free of clutter, dirt, and debris.

**C-4.8.13 Facilities Operations, Repair & Maintenance (FORM) Contract.** GRC LF has a stand-alone contract for the operations, repair and maintenance of all institutional equipment and systems at the Center. This includes HVAC, plumbing, underground utilities, centralized plants (steam and chilled water), fire detection & suppression systems, chemical treatment of water systems, low & high voltage electrical, electrical dispatch services, life safety systems, and security systems.

Typical CROM/FORM interfaces include the following:

**C-4.8.13.1 Work Involving Underground Systems.** For work requiring maintenance or repair of underground piping or conduit (e.g., underground Combustion Air piping, Service Air piping, etc.), the FORM Contract will provide the excavation services.

**C-4.8.13.2 High Voltage Electrical System Switching, Scheduling & Isolation.** Work under this contract may require switching, scheduling and/or isolation of high voltage electrical systems (600 V and greater). These services are provided by the FORM Contractor. The Electrical Dispatch Office is located within the Central Control Building No. 143

**C-4.8.13.3 Cooling Tower Services.** As is indicated in this SOW, the CROM

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

Contractor is responsible for operations, maintenance & repair of five large GRC cooling towers. However, the FORM Contractor is responsible for maintenance and repair of the cooling tower fire detection/suppression systems and for the chemical treatment of the cooling tower water systems. Therefore, there must be coordination of these activities between the two Contractors.

**C-4.8.14 Test Facilities Operations, Maintenance & Engineering (TFOME).** GRC has a stand-alone contract for the operations, maintenance, repair and engineering of aerospace ground test facility equipment and systems. Many of these facilities utilize CPS services for simulating high speed, high altitude, or for air-breathing engine combustion requirements. Consequently, there may be coordination required between the CROM and TFOME Contracts.

**C.4.8.15 Electrical Power Switching, Scheduling and Outages.** For any work involving electrical voltages in excess of 600 V, the Contractor shall coordinate and schedule work with the Government's Power Dispatch Office, located in the Central Control Building No. 143.

**C-4.8.16 Interfaces With Other Contractors.** The CROM Contractor shall cooperate with GRC's CPS maintenance, research test cell maintenance, janitorial, waste disposal, security, logistics, construction, environmental, and all other contractors and avoid conflicts with the other contractors' performance and work schedules. Under no circumstances shall additional work be performed at the request of another contractor without the approval of the COR. In the event of conflicts with other contractors that cannot be satisfactorily resolved, the matter shall be referred to the COR for a decision.

**C-4.9. Operations & Maintenance Personnel Participation in GRC Projects.** Large repair, rehabilitation and new construction projects at GRC are typically accomplished outside the scope of this contract and are issued as Invitation for Bid (IFB) packages. Often, there is a need to include CPS operations and maintenance and/or Pressure Systems personnel participation during the final design, construction and turnover phases of these projects. This participation could ensure that equipment and systems are designed and installed with considerations for maintainability.

As directed by the COR, the CROM Contractor shall provide personnel to participate in the final design kickoff meeting and the 30%, 60%, and 90% progress meetings for these projects. These services shall be included as part of the Base Work scope for this contract.

If CROM services are required during the construction and/or turnover phases of these projects, this shall be covered under the IDIQ portion of this contract.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-5. GOVERNMENT FURNISHED PROPERTY AND SERVICES**

**C-5.1 General.** The Government will provide the Contractor the use of certain Government-owned facilities, equipment, materials, and information technology (IT) equipment. This property and these services shall be used only for activities associated with this SOW. The use of Government property for other purposes is prohibited. The use of Government Property must be in accordance with relevant Federal laws and regulations and all Agency and Center procedures. All such facilities, equipment, and materials will be provided at the start of the contract in "as is" condition.

**C-5.2 Joint Inventory.** The Contractor and the COR shall conduct a joint inventory during the phase in period but not later than five (5) days after commencing work under this contract to determine the exact number and serviceability of GFF, GFE & GFM (tools, equipment and materials, etc.) offered to the Contractor. Within thirty (30) days of this inventory, the Contractor shall provide the COR with a written listing of all facilities, equipment, tools and materials that the Contractor shall use and for which the Contractor shall assume accounting responsibility. Government furnished items shall not be removed from the NASA Glenn Research Center, unless approved in advance by the COR.

The Contractor and the COR shall conduct a joint inventory once a year and the Contractor shall provide an inventory list at any time throughout the life of the Contract upon request by the COR.

**C-5.3 General Inventory.** The Contractor shall maintain an inventory list of all mechanical parts and materials, including spare part over \$500 and inventory of all Electronic equipment, including spare parts over any Dollar amount. In addition, the Contractor shall report on all changes to inventory once a month to the COR.

**C-5.3.1. Quarterly Spare Part Inventory Reports.** The Contractor shall provide a quarterly report detailing the current spare parts inventory list, highlighting the critical spares that are below the minimum quantity required, along with changes to the inventory and proposed purchase requirements for replacement parts to maintain inventory at required operational backup level. The Contractor shall provide this report to the COR by the 15<sup>th</sup> of September, December, March and June. Included in the report shall be a list of equipment out for repair along with estimated return to service date. The Contractor shall use one standard program for managing and reporting on the status of all spare parts inventories used to support all the systems, equipment, and components covered under this contract.

**C-5.4. Government Furnished Equipment (GFE).** The Government will provide the Contractor the use of existing and available Government owned tools and equipment in the performance of the contract. Such Government furnished tools and equipment are listed in Attachment J C.XX. Upon completion or termination of the contract, all Government-furnished tools and equipment, including specialized PT&I equipment and tools, shall be returned to the Government in the same condition as received, except for normal wear and tear. Tools and equipment that become worn out due to normal wear and tear shall be returned to the Government and their replacement shall be determined by the COR. The Contractor shall be held responsible for the cost of any repairs in accordance with the "Government Property" Clause of this Contract, FAR 52.245-1(Alt 1), Subsection (h). GFE shall not be removed from GRC Lewis Field unless approved in advance by the COR. At no time shall the Contractor dispose of GFE. A current listing of Government furnished tools and equipment is in the Section J Attachment H.

C-5.4.1 All software and maintenance licenses shall remain property of the Government and shall be acquired under a Government name.

**C-5.5. Government Furnished Material (GFM).** Government owned material previously purchased to support the equipment and systems included in this contract, will be furnished to the Contractor on a "one-time" basis for use exclusively at the Glenn Research Center. The Contractor shall certify the findings of the joint inventory as described in Section C-9.2, assume accounting responsibility for all

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

materials supplied, and shall provide documentation supporting issue/use of such material. On depletion of material provided to the Contractor by the Government, the Contractor shall purchase necessary material to perform the work of the contract, except as otherwise specified herein.

**C-5.6 Government Furnished Facilities (GFF).** Government-Furnished Facilities (GFF). The Government will furnish or make available to the Contractor the facilities (buildings, structures and systems, etc.) described in Attachment J C.5.1. Floor plans for GFF are found in Attachment J-C.5.2. These facilities include office areas, conference rooms, shop areas, equipment storage areas, and materials storage areas. Should the Contractor choose to use the Government-furnished facilities, adequate precautions shall be taken by the Contractor to prevent fire hazards, odors, and the infestation of vermin. The Contractor shall obtain written approval from the Contracting Officer prior to making any modifications or alterations to GFF. Any such modifications or alterations approved by the Government will be made at the expense of the Contractor. At the completion of the contract, all facilities shall be returned to the Government in the same condition as received, except for reasonable wear and tear, and approved modifications and alterations. The Contractor shall be held responsible for the cost of any repairs caused by negligence or abuse on the Contractor's or on the Contractor's employees' part.

Basic janitorial services will be provided within GFF at no additional cost to the Contractor. These include trash collection, occasional floor cleaning and/or sweeping, and cleaning of restroom facilities. Recycling of office paper, aluminum cans, and plastic bottles will also be provided..

**C.5.7 Government-Furnished Utilities (GFU).** The Government will furnish the following utility services for the Contractor's use within the GFF at no additional cost to the Contractor (i.e., utilities will not be separately metered within GFF and back-charged to the Contractor):

- C.5.7.1 Low voltage electricity for lighting and power.
- C.5.7.2 Low pressure steam or heating hot water for HVAC (as required).
- C.5.7.3 Natural gas for HVAC and hot water (as required).
- C.5.7.4 Hot & cold potable water.
- C.5.7.5 Sanitary and Storm sewage service.
- C.5.7.6 Service Air/Shop Air (125 psig) for shop tools.

**C-5.8 Government Furnished Information Technology (IT) Systems.** The Contractor will be provided the number of Government-furnished land-line telephones and computer seats as defined below.

C.5.8.1 Land-line telephones. Land-line phones provide access to on-site GRC employees and contractors (Lewis Field and Plum Brook Station) and include unlimited local and long-distance calling capabilities. Telephone maintenance and repair services are also provided at no additional cost to the Contractor. Use of these land-line phones for non-business purposes is strictly prohibited.

C.5.8.1 Computer Seats. Computer seats (currently ACES seats) and connected to the NDC computer domain will enable Contractor employees to access NASA information systems and personnel within the NASA Active Directory. Computer stations are loaded with Microsoft Office software including Microsoft Outlook for e-mail and calendar services. In addition, these seats can be used to access the world-wide web. ACES seats will be furnished with software and hardware maintenance services and periodic hardware updates. Use of the ACES seats for non-business purposes is strictly prohibited. All ACES seat key strokes are monitored by an on-site

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

surveillance group, and misuse of this equipment will be addressed by GRC IT Security personnel and the COR.

**C-5.9. Equipment Lists.** Lists of equipment and components covered under this SOW are resident in CMMS, and other databases and are provided for reference in the Technical Reference Library.

Preliminary Draft

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-6. CONTRACTOR ACQUIRED MATERIALS (CAM)**

**C-6.1 General.** Other than that provided as Government Furnished Property and Services in Section C-5, the Contractor shall be responsible for acquiring material, parts, tools, and supplies for the performance of all work under this contract. All such CAM shall be considered cost reimbursable items under this contract. All Contractor employees are responsible for providing their own personal hand tools appropriate for their particular trade. The Contractor shall not charge the Government for any of their employees' personnel hand tools including tools damaged while providing services to the Government.

**C-6.2 CAM Purchases.** The Contractor shall coordinate with the COR and the COR shall approve all CAM purchase requests in excess of \$3,000.00 prior to purchase. The Government will not be obligated to reimburse the contractor for items exceeding \$3,000.00 when prior coordination has not occurred. The Contractor shall provide a real-time program that reports to the COR detailing all purchases made under this contract regardless of cost. The Contractor shall obtain competitive quotes for material purchased in accordance with the Contract clause entitled "Competition in Subcontracting". The Government will periodically review the purchases and may, at its discretion, lower the Contractor's purchasing authority if abuses are discovered.

**C-6.2.1 Approved Sources.** The Government may, at its discretion, direct the Contractor to purchase the required material and equipment from Government approved sources.

**C-6.2.2 Refunds.** Any refunds, rebates, credits, or other amounts (including any interest) accruing to or received by the Contractor or any assignee shall be paid or passed to the Government by the Contractor, to the extent they are properly allocable to costs for which the Contractor has been reimbursed by the Government under the contract.

**C-6.2.3 End of Contract.** At fifteen (15) days before the Contract End Date, the Contractor shall provide a report to the COR, detailing all CAM currently in possession of the Contractor and shall turn over all CAM to the Government. All CAM purchased under this contract remains the property of the Government.

**C-6.3 Parts, Components, Equipment, and Materials/Supplies.** The Contractor shall provide new or factory reconditioned direct replacement parts and components when providing maintenance, repair, and minor construction services as described herein. All replacement units, parts, components and materials installed by the Contractor shall be compatible with that existing equipment on which it is installed; shall be of equal quality to the original equipment specifications; shall be used in accordance with the original design and manufacturer intent and shall comply with the applicable specifications. If the original manufacturer has updated the quality of parts for current production, those parts shall be approved by the Government prior to procuring such parts.

**C-6.4 Documentation.** The Contractor shall obtain and maintain manufacturer's operating instructions and maintenance manuals on all new equipment installed by the Contractor. All documentation shall be stored in the TRL, as described in Section C-4.1.4.

**C-6.5 Material Certificates, Descriptive Data and Samples.** When requested by the COR, the Contractor shall submit applicable certificates of compliance, manufacturers' descriptive data, and product samples for evaluation.

- ✓ Material certificates and samples (where applicable) shall be obtained from material manufacturers attesting that materials meet minimum design specifications.
- ✓ Manufacturers' descriptive data shall include the name of the manufacturer, model number, catalog cut, and other identifying data and information describing the performance, capacity, rating, and application/installation instructions which clearly illustrate that the proposed item meets applicable standards.



**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

- ✓ Product samples shall include a sufficient quantity of material to allow for complete analysis and evaluation by the Government.

**C-6.6 Equipment Manufacturer's or Installer's Warranty.** Equipment, components, and parts with existing warranties shall not be removed or replaced without prior approval of the COR. All defects in material or workmanship, defective parts, or improper installation and adjustments found by the Contractor shall be reported to the COR so that necessary action may be taken. The Contractor shall maintain and keep an electronic record of the equipment, parts, and components that are covered by warranty and the duration of such warranties.

**C-6.7 Software Maintenance Upgrade Notices.** The Contractor shall obtain Service Agreements as required and approved by the COR.

Typical Software include:

Ansys	1 seat
Cosmos	1 seat
Solidworks	2 seats
PVElite	6 seats
Caesar	4 seats
CadWorks	1 seat
VCESage	unlimited
Arrow	1 seat
Fathom	1 seat
MathCad	unlimited
Anti-Virus	15 Laptops
Autocad	thru NASA

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-7. MANAGEMENT AND ADMINISTRATIVE REQUIREMENTS**

**C-7.1. Contract Management and Administration.** The Contractor shall manage the total work effort associated with Central Process System Recertification, Operations, Maintenance, Repair, and all other services required herein to assure successful and timely completion of services in this contract. Included in this function are the full range of management and administrative responsibilities.

Sustaining corporate knowledge and continuity of services are critical to the success of Glenn Research Center's mission. Evaluation criteria in both the Mission Suitability Factors and in the Incentive Fee Evaluation Plan, once the contract is awarded, will place emphasis on the contractor's ability to sustain corporate knowledge.

**C-7.2. Contractor Personnel**

C-7.2.1. Staffing. The Contractor shall provide a staff of personnel with the necessary expertise and qualifications to assure the work is performed in accordance with the standards specified herein.

C-7.2.2 Project Manager. The Contractor shall appoint an on-site Project Manager with the authority for all coordination and direction of activities.

C-7.2.3. Critical Personnel Listing. The Contractor shall provide to the COR a list of the Contractor's critical personnel and a means of contacting these individuals in the event of an emergency or during off-hours. The Contractor shall notify the COR of changes in the list of the Contractor's key personnel within three (3) working days.

C-7.2.4. Contractor Licensing, Certification, Qualification and Specific Experience Requirements. The Contractor shall provide personnel that have the appropriate skills for that trade. The degree of skills shall be commensurate with that required for the work. Those personnel working in trades, whose performance requires license or certification or both, shall be so licensed/certified and said documentation shall be made available to the COR upon request. The Contractor shall have all necessary licensing, certification, qualification and training requirements for performing work under this contract remain current. Training classes shall be approved by the Government.

C-7.2.4.1 CPS Equipment Operator Qualification For qualifications of the CPS Equipment Operators see Section C.8.

C-7.2.4.1 PSO certification requirements For certification and qualification for the PSO personnel see Section C.9.

C-7.2.5. Security Access. The Contractor will be required to work in critical access areas at GRC. Contractor employees needing regular access to these areas to perform their jobs shall be trained by the Government for access and the Contractor shall obtain proper badges to allow easy access for accomplishing work.

C-7.2.6. Training. The Contractor shall provide the necessary training to insure that personnel have the appropriate skill levels to perform their trade. This includes training to maintain or acquire additional skills. The Contractor shall be required to submit a Training Plan to the COR for review and approval on a semi-annual basis.

**C-7.3. Computerized Maintenance Management System.** The Contractor shall utilize the Government's Computerized Maintenance Management System (CMMS) to manage activities required by this contract. The Government system is currently MAXIMO. Other mandatory CMMS entries include observed operating conditions, assessment of equipment, deficiencies

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

detected, corrections made, and quantities and types of material repaired or replaced. The Contractor shall adhere to Federal, NASA and GRC Information Technology (IT) policies.

C-7.3.1. The Contractor shall be able to perform the required CMMS functions at the start and for the duration of this contract. The Contractor shall not attempt to interface the Government CMMS system with any other CMMS, database, spreadsheet, or other software programs. The Contractor shall not log or record any proprietary information on the MAXIMO system.

C-7.3.2. Maintaining, Populating, and Updating CMMS Data. The Contractor shall continually update the CMMS database and is responsible for its accuracy as it relates to this SOW. All documents shall be filed or entered within two (2) working days after completion of each preventive maintenance, inspection, recertification, etc. event. Within thirty (30) days after contract start, the Contractor shall provide in writing to the COR an overall assessment of the accuracy of the information contained in the CMMS database as it relates to this SOW.

C-7.3.3. The Contractor shall follow the procedures in Technical Exhibit J-C-7.2, Section J to ensure CMMS is current and that all of the equipment and tasks are accurately entered.

**C-7.4. PSD Pressure Systems Database.** The Contractor shall update and maintain information within the Pressure Systems Database (PSD). Data to be maintained includes physical configuration data (component brand, make, model, size, and capacity information, etc.) of components and systems, as well as In-Service Inspection (ISI) status information of components and systems. The contractor shall occasionally be required to coordinate updates or repairs to the PSD application by working with GRC IT staff separately assigned to administer/program the application. The contractor shall perform regular audits and error checks of PSD to assure data integrity.

**C-7.5. Risk Management Plan.** The Contractor shall perform Risk Management and Assessment to identifying the top risks that may impact performance on this contract, as viewed by the Contractor, and the proposed mitigating strategies for those risks identified.

**C-7.6. Contractor Quality Control (QC).** The Contractor shall provide a Quality Control Plan within 30 days of award. The Contractor shall establish and maintain a Quality Control Program to ensure that the work performed under the contract conforms to the contract requirements.

**C-7.6.1. Preventive Maintenance.** As part of the Contractor's QC plan, the contractor shall submit a list of the Monthly PM Work Schedule Report as per Section C-3.xxxx.

C-7.6.1. Random Sample. At a minimum, the Contractor shall choose, at random, 10% of the work orders completed and submitted them for inspection by the Contractor's own Quality Assurance Manager.

**C-7.6.2. IDIQ Tasks** As part of the Contractor's QC plan, the contractor shall indicate how they shall provide quality inspections with each IDIQ Task, which includes but not limited to Final walk-throughs with TR and COR.

**C-7.7. Government Quality Assurance (QA).** All services performed by the Contractor are subject to Government inspection. The Government's Quality Assurance Surveillance Program (QASP) is not a substitute for quality control by the Contractor. The Government reserves the

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

right to choose the inspection method and vary the inspection methods utilized during the work, without notice to the Contractor.

**C-7.8. Work Control.** The Contractor shall implement all necessary work control procedures to ensure timely and successful completion of work requirements, as well as to permit tracking of work in progress. The Contractor shall plan and schedule work to assure material, labor, and equipment are available to complete work requirements within the specified time limits and in conformance with the quality standards established herein. Upon the request from the COR, schedule and status reports shall be provided within the time frame specified in the request.

**C-7.9. Operations Plan.** Within thirty (30) days following award of the contract, the Contractor shall provide to the COR, the Operations Plan that describes how the operational requirements included in this contract shall be accomplished. The Operations Plan shall be submitted in writing and in an acceptable electronic format. The Operations Plan shall include written procedures, check sheets, and define the qualifications and duties of assigned equipment and system operators.

C-7.9.1. As a minimum, the Operations Plan shall define how the Contractor shall [1] manage, operate, control, monitor and inspect the CPS, instrumentation, control, mechanical, electrical, and electronic equipment, associated ancillary and auxiliary equipment and systems for proper operation; [2] perform OCMR and PMs; [3] report problems; [4] troubleshoot equipment or system failures and; [5] make minor adjustments to equipment located throughout the research support facilities; [6] perform cross-training.

**C-7.10. Progress Review Meetings.** The Contractor shall conduct monthly Recertification, Operation and Maintenance progress meetings with the Government. The monthly meeting will review overall contract status, work completed versus work scheduled, problems, issues and concerns. The meeting shall be held during the third week of the month.

C-7.10.1 Participation in Other Meetings. The Contractor shall participate in other meetings as requested by the COR and other Work Order/Task Order requirements.

**C-7.11. Communication with other Government personnel.** The Contractor shall communicate and inform other Government personnel including CORs, ACORs, Systems Managers, Facilities Managers, Building Managers, and System Engineers in emergency situations and when deemed necessary based on the situation.

**C-7.12. Documentation.** The Contractor shall follow configuration control guidelines for the CPS included in the technical library. The Contractor shall be responsible for updating and maintaining all record drawings, electrical and mechanical one-line wiring and elementary drawings, software ladder-logic schematics, manuals, reports, check-sheets, and all other documentation (including software documentation) which comprise the CPS and associated PSPV systems for all work performed under this contract, and work by others as directed by the COR. The Contractor shall utilize NASA specified software packages, as appropriate, to update documentation.

C-7.12.1. The Contractor shall submit to the COR within three (3) working days, following implementation of Government approved changes, copy of updated red-line prints indicating all changes which are the result of equipment repairs, component replacements, modifications, alterations, deletions or additions on the applicable

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

drawings/maps upon completion of the work or any findings. The Contractor shall have thirty (30) working days from the time red-lined drawings are submitted to complete the final updating of applicable drawings, unless otherwise stipulated by the COR. Within five (5) working days before the contract completion date, the Contractor shall turn over all drawings to the COR. The Contractor shall follow the GRC configuration control guidelines regarding the configuration control of drawings and components.

Preliminary Draft

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-8. OPERATIONS, MAINTENANCE & IMPLEMENTATION OF DISCRETE TASKS**

**C-8.1. OPERATIONS REQUIREMENTS.**

Operations, for the purposes of this SOW, is defined as the services required, from day-to-day, to enable the CPS to provide the required services to GRC's research community.

**C.8.1.1. Operations includes:**

- ✓ Console and equipment operations functions,
  - ❖ start, control, and monitoring,
  - ❖ shutdown,
- ✓ Field equipment operations,
  - ❖ watch-standing and tending,
  - ❖ equipment and system pre-run checkout and setup,
  - ❖ post-run checkout,
  - ❖ securing of the equipment following shutdown, and
- ✓ End-to-end troubleshooting
  - ❖ OCMR of the auxiliary, ancillary and distribution systems.
- ✓ Correction of equipment problems, malfunctions, breakdowns, and related repair deficiencies that occur and which may effect scheduled research operations.
- ✓ Central-Air Dispatch Operation

**C-8.1.2. Operations personnel shall be qualified as:**

- ✓ Field Equipment Operator (FEO),
- ✓ Field Console Operator (FCO),
- ✓ Senior Console Operator (SCO),
- ✓ Super Senior Console Operator (SSCO)

Each shift of operation in each building shall contain one SCO as a minimum during operation along with the necessary FEOs and FCOs.

**Troubleshooting** is defined as finding a problem, starting with the operator console, and everything in between all the way to the field device. The Contractor shall make every attempt to troubleshoot and resolve issues utilizing their staff. If problem persists, the Contractor shall contact the appropriate engineers within the Facilities Division for troubleshooting assistance and engineering support

**Watch-standing and Tending** is defined as attendance type work requiring the presence of qualified persons to perform specific duties during a specific or scheduled time period.

The Contractor shall perform work in accordance with the operations and maintenance manuals, procedures and manufacturers' literature.

The Contractor shall ensure that all equipment remain clean, free of oil and dirt. The Contractor shall also ensure all equipment appears pristine and ready for tours and inspection at all times.

**C-8.1.3. Equipment Operation.** The Contactor shall operate the following:

- ✓ 10 psig Refrigerated Air Systems and Expanders (TE-3,4,5 & 6),

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

- ✓ 40 psig Air Compressors (C-1,2,10,11,12,13),
- ✓ 150 psig Air Compressors (C-3,7,16 & 17),
- ✓ 450 psig Air Compressors (C-4,5 & 18),
- ✓ 1250 psig Air Compressor (C-8),
- ✓ 125 psig Service Air Compressors (SA-20,21,22,23),
- ✓ Altitude Exhausters (E-38, 39,40,41,42,43,44,45,46 & 47),
- ✓ Atmospheric Blowers (AEF-19 & 20),
- ✓ Variable Frequency Power System (Converters C,D,E,F,G,H,J,K,L & M), and the
- ✓ Cooling Towers (CT 1, 3, 4, 5 & 6).

**C-8.1.3.1.** The Government may modify/add/delete systems in the future. Lists of equipment, manuals, and components covered under this PWS are resident in CMMS, ADEPT (the Government's Configuration Control System) are given in Section J-C-3.1.2.1. The Technical Reference Library, which will be available for viewing at NASA Glenn Bidder's Library.

**C-8.1.3.2.** The Contractor shall be responsible for maintaining any other databases deemed necessary, by the Contractor, for the efficient administration of this contract.

**C-8.1.3.3.** The Contractor shall operate all the auxiliary and/or ancillary systems associated with the equipment identified such as, but not limited to, oil and hydraulic systems, exciter sets/excitation units, High and Low Voltage electrical systems and/or switchgear, Cooling Tower Water systems, and de-watering systems.

**C-8.1.4. Continuous Operations.** Service Air and Cooling tower operations are continuous and are required even when other CPS systems may not be operating and generally run unattended during off hours.

**C-8.1.5. Operations Corrective Repair (OCR).** OCR is inherent to equipment and systems operations. It includes work identified by the Contractor, or the Government, during, before, or after operations, as necessary to correct problems that would interfere with scheduled operations or to prevent injury to people, equipment or the environment.

**C-8.1.5.1.** The Contractor shall report any and all equipment problems, malfunctions, breakdowns, and related repair deficiencies in the Daily Run Report.

**C-8.1.5.2.** The Contractor shall inform CAD and ED when the problem has been identified and corrective action planned. All OCR work shall be reported in CMMS in the form of Work Orders.

**C-8.1.5.3.** The Contract shall not alter any hardware or equipment without the approval of the COR. The Contractor shall be allowed to replace defective parts found during the troubleshooting process with like kind components

**C-8.1.6. OCR Work Orders.** The Contractor shall perform the OCR Work Orders as soon as possible to get CPS equipment available for the next run, to ensure that all operational requirements are met.

**C-8.1.6.1.** OCR Work Orders are limited to \$5,000.00. In the event that an OCR work order is expected to exceed this limit, the Contractor shall notify the COR immediately to insure continuity of work.

**C-8.1.7. Operation of CPS Control Equipment.**

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-8.1.7.1.** The Contractor shall be responsible for day to day operation of the Central Process DCS hardware. This includes the ability to troubleshoot and identify problems with the computer/network hardware such as:

- ✓ DEC Alpha,
- ✓ IBM PC-compatibles,
- ✓ Bridge Controllers (BRC),
- ✓ Programmable Logic Controllers (PLC),
- ✓ PLC I/O,
- ✓ Compressor Control Corporation (CCC) Controllers,
- ✓ Solid-State Exciters,
- ✓ Static Frequency Converters (SFC),
- ✓ Uninterruptible Power Supplies (UPS) and
- ✓ Software including operating systems, networking protocols, languages and database management systems such as:
  - ✓ VMS,
  - ✓ UNIX System V,
  - ✓ MS-DOS,
  - ✓ MS Windows,
  - ✓ TCP/IP,
  - ✓ DECnet,
  - ✓ NETBIOS,
  - ✓ BASIC,
  - ✓ Visual BASIC,
  - ✓ C,
  - ✓ SQL,
  - ✓ dBase III+ and compatibles,
  - ✓ Function Code Software,
  - ✓ "C" utility program (FDI),
  - ✓ Human-machine interface graphics display software,
  - ✓ PLC software and other hardware and software added during the life of the Contract.

**C-8.1.7.2.** The Contractor shall be responsible for correcting all hardware related problems. The Contractor shall notify the COR of any problem found and/or corrected in order for the Government to correct all software related problems identified during troubleshooting.

**C-8.1.8. Operation Procedures.** The Contractor shall update and maintain all operating procedures, such as, Operations check sheets, hardwired shutdown procedures, calibration procedures, LO/TO procedures, and all other related procedures located in the Operator's Console. Examples are given Section J-C-8.1.7. The Contractor shall obtain the Government's



## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

approval prior to making any final changes to the procedures. The Contractor shall maintain all these procedures on the Operator Consoles.

**C-8.1.8.1.** The Contractor shall provide annual reviews and update of the CCB CP-DCS operators' sequence check sheets. The Contractor shall obtain Government approval prior to implementation.

**C-8.1.8.2.** The Contractor shall maintain communications with the Government, specifically the Central Air and Electric Power Dispatcher personnel. Communications shall include, but are not limited to: daily operational requirements, changes made throughout the course of the day that effect operations, coordination of operational activities, troubleshooting of control and operational problems, preparation of equipment for inspections and testing, and conducting necessary system isolation and safety Lockout/Tagout (LO/TO) activities.

**C-8.1.8.3.** The Contractor shall issue an accurate daily run report that identifies all tagged out equipment, all equipment used throughout the day, any anomalies and corrective actions taken. Example of daily run report is given in Section J-C-8.1.7.3.

**C-8.1.8.4.** The Contractor shall communicate any issues and concerns related to the CPS to the Government personnel including CORs, ACORs, Systems Managers, Facilities Managers, Building Managers, and System Engineers when deemed necessary based on the situation.

**C-8.1.8.5.** In certain testing configurations the Contractor shall be required to maintain communications with the test researcher. These testing configurations shall be made known to the Contractor as soon as they are identified by the Government.

**C-8.1.9. Scheduling of Operations.** The Government's Central Air Dispatcher (CAD) makes the final determination as to which equipment will run on any given day for research and equipment/system testing. CAD issues a daily Research Facility Test/Central Process Services Systems Requirement Schedule, which is often modified during the morning Conference Call and is updated throughout the day. This web-based schedule will serve as notification to the Contractor of equipment requirements needed to support research operations for each day. The Contractor shall maintain communications with CAD, and observance of the published operations schedule, to ensure the Contractor meets all operations requirements. The Contractor shall keep CAD up-to-date on equipment availability.

**C-8.1.10. Central Process Services System (CPSS).** The Central Process Systems requirement's schedule is published every Thursday by the CAD and is normally available over the Integrated Desktop Environment (IDE) network by 2:00 p.m. The Contractor's first priority shall be to ensure the equipment is ready for operation to meet the research requirements. Examples of the CPSS schedule are given in Section J-C-3.1.9.

**C-8.1.10.1.** The Government retains the right to update the schedule throughout the week, as research requirements, equipment problems, and changing priorities among research and maintenance groups occur.

**C-8.1.10.2.** The "start" and "stop" times indicated on the schedule refer to the times that the specified test cells are scheduled for CPS services to begin and end. The Contractor shall ensure that pre-run checks, setups, starts, synchronization, loading, coupling, paralleling operations, etc. are completed within a time frame that allows those start and stop times to be met.

### **C-8.1.11. Specialized Operations Requirements**

**C-8.1.11.1.** The Contractor shall provide the necessary operator services to transfer, vaporize, cascade and/or pump liquid and gaseous hydrogen when required on a work order basis.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-8.1.11.2.** The Contractor shall be responsible for day to day operation of the Central Process DCS hardware and software including software configuration control. This includes the ability to troubleshoot and identify problems and take corrective action with computer/network hardware such as the DEC Alpha, IBM PC-compatibles, Bridge Controllers (BRC), Programmable Logic Controllers (PLC), PLC I/O, Compressor Control Corporation (CCC) Controllers, Solid-State Exciters, Static Frequency Converters (SFC), Uninterruptible Power Supplies (UPS) and software including operating systems, networking protocols, languages and database management systems such as VAX/VMS, UNIX System V, MS-DOS, MS Windows, TCP/IP, DECnet, NETBIOS, BASIC, Visual BASIC, C, SQL, dBase III+ and compatibles, Function Code Software, Batch 90 software, "C" utility program (FDI), human-machine interface graphics display software, PLC software and other hardware and software added during the life of the Contract.

**C-8.1.12. Hardware Shutdown Verifications & Calibrations.** The Contractor shall verify the Hardware Shutdowns and Calibrations on any system or piece of equipment which has been taken out of service for major repair or rehabilitation or has been replaced due to component failure or wear.

**C-8.2. MAINTENANCE & REPAIR REQUIREMENTS**

**C-8.2.1. General Maintenance & Repair Requirements.** The Contractor shall perform:

- ✓ preventive maintenance,
- ✓ inspections,
- ✓ calibration on all CPS related systems requirements. A representative sample of the calibration sheets are shown in the Technical Reference Library.
- ✓ repairs
- ✓ PT&I

**C-8.2.2 Maintenance Standards.** The Contractor, using the guidelines set forth in NASA NPD 8831.1E, <http://nodis.hq.nasa.gov/displayDir.cfm?t=NPD&c=8831&s=1E>, Maintenance and Operations of Institutional and Program Facilities and Related Equipment and NPR 8831.2E, <http://nodis.hq.nasa.gov/displayDir.cfm?t=NPR&c=8831&s=2E> Facilities Maintenance Management, shall recommend:

- ✓ additions,
- ✓ deletions, and
- ✓ modifications to the current maintenance activities to the Government;

**C-8.2.2.1.** All recommendations made by the Contractor shall be cost effective and geared to increase the overall reliability and ensure continuous improvement to the health of the CPS.

**C-8.2.2.2.** The Government will provide minimal preventative maintenance procedures which will be available in the Technical Reference Library and otherwise will be listed in the Government's Computerized Maintenance Management System (CMMS).

**C-8.2.2.3.** Copies of NASA NPD 8831.1E Maintenance and Operations of Institutional and Program Facilities and Related Equipment and NPR 8831.2D Facilities Maintenance Management can be found in the Technical Reference Library.

**C-8.2.2.4.** The Contractor shall provide a review of the government's annual maintenance plan.

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

**C-8.2.3. Field Surveys.** The Contractor shall conduct field surveys and document findings of systems and components to verify configuration and component information.

**C-8.2.4. Condition Based Maintenance.** The Contractor shall collect information from condition monitoring equipment installed throughout the CPS and provide a monthly report summarizing the data collected. Data shall be collected from vibration monitoring equipment, oil analysis, bearing temperature signature, and thermographs. The Contractor shall utilize current PT&I equipment to collect data when applicable. Any problems found during the performance of this activity shall be corrected as soon as practical and shall be documented in the CMMS.

**C-8.2.4.1.** The Contractor shall identify inherent reliability problems, ineffective maintenance, and work with the COR to enhance maintenance approaches.

**C-8.2.5. Equipment Baseline Data Checks.** The Contractor shall perform the necessary checks to verify baseline data for such criteria as alignments, vibrations, clearances, flows, electrical signatures, temperatures, and other observable conditions on any system or piece of equipment which has been taken out of service for major repair or rehabilitation or has been replaced due to component failure or wear.

**C-8.2.6. Scheduling of All Maintenance Activities.** The Contractor shall document a completion date for all PM work on the monthly PM Work Schedule Report and shall complete all scheduled PM's during the period specified in the work order.

**C-8.2.6.1.** Monthly Preventative Maintenance Work Schedule Report. The Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or about the 20<sup>th</sup> of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month.

**C-8.2.7. Preventive Maintenance (PM) Requirements.** The maintenance schedule shall accommodate PM procedures as defined in the CMMS database and include routine scheduled items.

**C-8.2.7.1. Procedures.** PM procedures are defined in the Work Instructions resident in CMMS, and provided for reference in the Electronic Bidders Library. The Contractor shall use CMMS to manage its PM program. The Contractor activities shall include updating records, procedures, instruction codes, nameplate data, scheduling, and recommending improvements to GRC's PM program. The data entered in CMMS becomes the property of the Government.

**C-8.2.8. Reliability Centered Maintenance (RCM).** The Contractor shall assist the Government in the development of an RCM program according to the guidelines defined in NPR 8831.2E. The RCM program should optimize the use of:

- ✓ preventive maintenance,
- ✓ predictive testing and inspection,
- ✓ run-to-failure, and
- ✓ proactive maintenance measures

to minimize equipment maintenance costs and unnecessary equipment overhauls and maximize uptime availability and reliability. These four (4) maintenance measures draw upon their respective strengths to maximize equipment operability and efficiency while minimizing required maintenance time, materials, and costs.

**C-8.2.8.1. Root Cause Failure.** NASA considers root cause failure analysis to be an essential proactive maintenance element. The Contractor's RCM strategy shall be based upon a statistical analysis of historical data related to failures to determine the optimal investment of maintenance resources and risk assessment methods to identify those processes or systems that statistically exhibit the greatest chance of catastrophic failure.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-8.2.8.2.** The COR will approve the Contractor's RCM plan. After implementation of the approved plan, the Contractor shall document the results of the RCM activities and report the findings to the COR upon request. During the course of the contract, any additional cost savings that result directly from the RCM strategies developed and implemented by the Contractor may be considered for inclusion under the "Shared Savings" clause of this contract. The Government reserves the right to inspect and recommend modifications to the Contractor's RCM program at any time

**C-8.2.9. Predictive Testing & Inspection (PT&I).**

**C-8.2.9.1. Contractor PT&I Program.** The Contractor shall develop capabilities to perform PT&I maintenance activities. These capabilities will be used to improve maintenance and equipment reliability as a basis for the consideration in eliminating certain PM tasks. During the course of the contract, any additional cost savings that result directly from the PT&I strategies developed and implemented by the Contractor may be considered for inclusion under the "Shared Savings" clause of this contract. Any Contractor developed PT&I capabilities and program must be approved by the Government before any such work or plans are implemented by the Contractor. These activities can consist of, but not necessarily be limited to ultrasound, thermography, oil analysis, vibration analysis, motor circuit evaluator, motor power monitoring, acoustical leak detection, and others. The Contractor shall make all test data results available to the COR.

**C-8.2.9.2. Contractor Support of Government PT&I.** The Government PT&I group may request Contractor support in performing their own tests, gaining access, and preparing the equipment and systems for PT&I tests. The Government will make every attempt to conduct its PT&I activities in conjunction with the Contractor's scheduled maintenance activities.

**C-8.2.10. Scheduling Unplanned Maintenance and Repairs.** Unplanned maintenance and repair are equipment problems or malfunctions that occur unexpectedly during the course of the day that require immediate attention by the Contractor to ensure equipment availability to meet the research and test schedule.

**C-8.2.10.1.** The Contractor shall plan and schedule this unexpected work to assure that materials, labor, and equipment are available to complete repairs within the specified time limits and in conformance with established quality standards.

**C-8.2.10.2.** The Contractor shall schedule work to minimize interference with the normal occurrence of Government business and mission, particularly CPS operations scheduled on the weekly Research Facility Test/Central Process Systems Requirement Schedule. Any repair task or replacement of obsolete item task (in-like kind) done by the Contractor shall be tested prior to operations

**C-8.2.11. Maintenance Corrective Repair (MCR).** MCR is inherent to equipment and systems maintenance. It includes work identified by the Contractor, or the Government, during, before, or after maintenance activities, inspections, or as necessary to correct problems that would interfere with scheduled operations or to prevent injury to people, equipment or the environment.

**C-8.2.12. MCR Work Orders.** The Contractor shall perform the MCR Work Orders as soon as possible to get CPS equipment available for the next run, to ensure that all operational requirements are met; MCR Work Orders are limited to \$5,000.00. In the event that an MCR work order is expected to exceed this limit, the Contractor shall notify the COR immediately to insure continuity of work.

**C-8.2.13. Automatic Controls, Valves, Hoses and Pump Services.** The Contractor shall:

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

- ✓ maintain,
- ✓ inspect,
- ✓ repair,
- ✓ recondition,
- ✓ supply,
- ✓ replace,
- ✓ install,
- ✓ modify,
- ✓ test, and
- ✓ calibrate all:
  - pneumatic,
  - hydraulic,
  - electro-pneumatic and
  - hydraulic control systems,
  - control valves (power or hand operated);
  - relief valves,
  - solenoid valves,
  - servo-valves,
  - vacuum valves,
  - large gate and butterfly valves,
  - pressure regulators,
  - accumulators,
  - high-pressure hoses;
  - pressure pumps,
  - vacuum pumps (mechanical, diffusion, ionization, turbo-molecular, and Roots blowers).
  - other ancillary equipment

**C-8.2.14. Facility and Research Equipment and Machinery Services.** The Contractor shall:

- ✓ maintain,
- ✓ inspect,
- ✓ repair,
- ✓ assemble,
- ✓ disassemble,
- ✓ relocate,
- ✓ lift,
- ✓ align,

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

- ✓ balance,
- ✓ replace,
- ✓ recondition,
- ✓ modify, and
- ✓ test:
  - light and heavy duty equipment,
  - plant machinery,
  - research machinery,
  - drive equipment and associated systems rated from fractional up through thousands of horsepower.
  - other ancillary equipment

This equipment is used in providing atmospheric exhaust, altitude exhaust, compressed air, cooling liquids, power absorption, refrigeration, and research equipment of all types.

**C-8.2.15. Maintenance Upgrade Notices.** The Contractor shall obtain the following Service Agreements as required by the COR.

- ✓ ABB
- ✓ Hummingbird Exceed X-Windows
- ✓ OSISoft PI Server
- ✓ Ipswitch WhatsUp Network Monitor
- ✓ GFI LANGuardSecurity Patching Software
- ✓ Solarwinds
- ✓ Data South Systems
- ✓ DBDOC
- ✓ EventSentry
- ✓ SymantecBackup, Antivirus, System Recovery
- ✓ SYMC Backup Exec Sys Rcvry Srvr 7.0 WIN
- ✓ IRD 885 Maintenance Srvce
- ✓ DLI Vibration Analyzer
- ✓ Uninterruptible Power Supply Service Agreement

The Government may modify this list of services agreements at any time during the life of this contract.

**C-8.2.15.1.** The Contractor shall provide an annual report to the COR which lists all anticipated service agreements, their renewal dates and costs by January 15<sup>th</sup> of every contract year.

**C-8.3. IMPLEMENTATION OF DISCRETE TASKS REQUIREMENTS**

**C-8.3.1. Discrete Tasks.** Discrete tasks are defined as build-up, repair, and testing activities of specific CPS tasks; including Program Maintenance Tasks.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

C-8.3.1.1. Regardless of the Government's funding source, the Contractor will receive a request to perform these discrete tasks with a Task SOW.

**C-8.3.1.2.** Regardless of the Government's funding source, the Contractor shall provide all the required labor, materials, and equipment to complete the task described in the Task SOW.

**C-8.3.1.3.** Regardless of the Government's funding source, the Contractor shall be responsible for purchasing, inventorying, and stocking all hardware and materials, including spare parts, required to complete the task described in the Task SOW.

**C-8.3.1.4.** The Contractor shall immediately notify the COR when a task's funding expenditure has reached the 85% level and is expected to exceed the agreed upon funding limit.

**C-8.3.1.5.** The Contractor shall exercise utmost caution to ensure that all charges incurred are accurately recorded against the specific task number provided by the Government for each discrete task.

**C-8.3.1.6.** The Contractor shall prepare all work implementation documents, including but not limited to, Safety Permits, individual task Health and Safety Plans, detailed schedules (using Microsoft Project), completion reports, update red-lined drawings, and other related documentation.

**C-8.3.1.7.** The Contractor shall provide to the COR a cost estimate for each Implementation Request within fifteen (15) calendar days of receipt of the request. The estimate shall provide detail on costs, materials, labor hours, and applicable fees.

**C-8.3.1.8.** The Contractor shall provide a Completion Report to the COR within thirty (30) calendar days after task completion.

**C-8.3.1.9.** The Contract shall use Microsoft Office Suite Project to monitor all work schedules and work activities. Schedule for task will be defined during the task "Kick Off" meeting.

**C-8.3.2. Red Line Drawings and Documentation.** The Contractor shall, within fifteen (15) calendar days after the completion of work, provide to the COR, all related updated red-line drawings and documentation. The documentation shall consist of mark-ups to drawings provided with the SOW, operational- instructional-maintenance manuals for purchased equipment, and annotated software documentation.

**C-8.3.2.1.** The Contractor shall post a copy of all required documentation in the general area of the work tasks.

**C-8.3.2.2.** The Contractor shall update operating procedures associated with each task.

**C-8.3.3. Workmanship.** The Contractor shall ensure that all installation and connections of all equipment shall be in accordance with all applicable codes and standards.

**C-8.3.3.1.** The Contractor shall ensure that all equipment provided will be arranged or installed as to provide unobstructed access to existing equipment or items requiring maintenance.

**C-8.3.3.2.** The Contractor shall ensure that all installation projects shall be implemented in a manner that minimizes interference with CPS operations.

**C-8.3.4. Acceptance Testing.** The Contractor shall provide the COR with all factory acceptance testing documents of equipment prior to installation.

**C-8.3.4.1.** When specific tests are required, the Government shall provide the Contractor a list of such tests. The Contractor shall prepare a test plan outlining the procedures to be followed for

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

conducting such tests. The Contractor's test plan shall define, at a minimum, each step of the test to be performed in detail, participant responsibilities, documentation for tests, duration of tests, and procedures for dealing with discrepancies and failures during the test.

**C-8.3.4.2.** The Contractor shall prepare a test report document certifying successful completion of each field acceptance test. The Contractor shall submit these test reports to the COR along with all the required reports as specified in the task SOW.

**C-8.3.5. Training.** The Contractor shall develop operational procedures and provide appropriate training as required to support new and existing equipment as covered under this contract. In addition to training their own staff, the Contractor shall provide training to various personnel including Government and other GRC support service contractors. The Contractor shall upon request of the COR provide a training report that details the training requirements and training activities of all their employees.

**C-8.3.5.1.** The Contractor shall document and store all their training records electronically in such a way as to pass spot audits. The Contractor shall be required to submit their training records to the COR upon request.

### **C-8.4 OPERATIONS, MAINTENANCE AND IMPLEMENTATION PERSONNEL REQUIREMENTS**

**C-8.4.1. Operations Personnel.** The Contractor shall provide qualified personnel to accomplish Operation activities associated with the CPS, CPSDC and its support systems and equipment in the performance of this contract. The Operations personnel shall be comprised of:

- ✓ Electrician Maintenance Personnel,
- ✓ Machinery Maintenance Mechanics, and
- ✓ Electronic Technician Maintenance III

**C-8.4.1.1. Field Equipment Operator (FEO).** The FEO shall perform equipment watch-standing duties during start-up and rover duties during operations.

**C-8.4.1.1.1.** The FEO shall perform the field pre-runs and post-runs for the equipment being operated that day.

**C-8.4.1.1.2.** The FEO shall have sufficient electrical, electronic and/or mechanical skills to perform day-to-day watch-standing operations, maintenance and troubleshooting, and have at least five (5) years of experience on operating similar types of equipment.

**C-8.4.1.2 Field Console Operator (FCO).** The FCO shall be qualified as an FEO as a prerequisite. The FCO shall be responsible for configuring, starting, stopping, controlling and monitoring the CPS equipment from the field consoles. While the equipment is in operation, an operator must be present at the console to make adjustments, monitor conditions for alarms and any anomalies.

**C-8.4.1.3 Senior Console Operator (SCO).** The SCO shall be qualified as a FCO as a prerequisite. The SCO shall have background knowledge in CPSDC and the associated controls equipment and instrumentation.

**C-8.4.1.3.1.** SCO shall be able to troubleshoot and identify problems with the:

- ✓ Operator Consoles,
- ✓ ABB Company's Bridge Controllers programmed with languages such as Function Code software,



**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

- ✓ Programmable logic controller (PLC) sequence logic, process controls,
- ✓ CCC pressure and Surge Controllers,
- ✓ Input/Output devices,
- ✓ S800 I/O,
- ✓ Field devices such as Exciters, Multilin/PQM/IQs, Servo-amplifiers, transmitters, and any other devices used for monitoring and control.

**C-8.4.1.3.2.** The SCO shall also be responsible for maintaining and troubleshooting all computer related hardware such as, but not limited to, computers, computer servers, routers, switches and all other network related hardware.

**C-8.4.1.3.3.** The SCO shall not modify the system or the system's programming without prior Government approval.

**C-8.4.1.4. Super Senior Console Operator (SSCO).** The SCO shall be qualified as a SCO as a prerequisite. The SSCO shall have full understanding of how all components of CPS including CPSDC work together to deliver CPS Services to our Researchers. They shall be able to perform first line end-to-end troubleshooting without Government or Engineering assistance.

**C-8.4.2. Maintenance Personnel.** The Contractor shall provide qualified personnel to accomplish Maintenance activities associated with the CPS, CPSDC and its support systems and equipment in the performance of this contract. Maintenance personnel shall have a minimum of three (3) years of experience in their respective technical fields. The Maintenance personnel shall be comprised of:

- ✓ Machinery Maintenance Mechanics, and
- ✓ Engineering Technicians (IV and V)
- ✓ Pipefitter Maintenance
- ✓ Millwright

**C-8.4.2.1. Mechanical Coordinator.** The Mechanical Coordinator shall be responsible for coordination of all mechanical tasks performed by the Contractor.

**C-8.4.2.1.1.** The Mechanical Coordinator shall also coordinate scheduling with the Electrical Coordinator.

**C-8.4.2.1.2.** The Mechanical Coordinator shall be responsible to verify that all the equipment has been purchased for all the tasks.

**C-8.4.2.1.3.** The Mechanical Coordinator shall be the point of contact with the Central Air Dispatch.

**C-8.4.2.2. Electrical Coordinator.** The Electrical Coordinator shall be responsible for coordination of all electrical tasks performed by the Contractor.

**C-8.4.2.2.1.** The Electrical Coordinator shall also coordinate scheduling with the Mechanical Coordinator.

**C-8.4.2.2.2.** The Electrical Coordinator shall be responsible to verify that all the equipment has been purchased for all the tasks.

**C-8.4.2.2.3.** The Electrical Coordinator shall be the point of contact with the Electrical Dispatch.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

*Preliminary Draft*

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-9. RECERTIFICATION REQUIREMENTS**

**C-9.1 Certification Requirements**

**C-9.1.1 General Scope of work for PV/S Certification.** Certification of PV/S include review of the existing documentation, preparation for inspection, visual and non destructive examinations, engineering evaluation, risk assessment and recommendation to meet the requirements and actual repairs necessary to meet the requirements. The Contractor shall review all related existing documentation, generate new drawings if required, make all necessary preparations for inspection, perform all visual and non destructive examinations, conduct all engineering evaluations, develop risk assessment documentation and develop a statement of work for repairs; and upon completion of the repairs, the contractor shall review and approve all supporting documentation involved with the repairs. The contractor shall be responsible for periodic in-service inspections and shall be responsible for maintaining the accuracy of the database on certification activities. Certification is defined as all activities including recertification, repairs and periodic in service inspections.

**C-9.1.2 Pressurized Systems Certifications Process.** The following paragraphs are provided for reference on how the certification process is currently conducted and the minimum qualifications of the key personnel involved. The qualifications of personnel are located within this section. The Contractor shall perform all PV/S certifications as described in the following chart. The technical certification personnel shall be comprised of Pressure Systems Engineers, Inspectors & Examiners and Drafters as described within this section.

**C-9.1.2.1 Certification Process and Flowcharts.** The current certification process, including flowcharts, is attached in see [Section C-9.1.2.1 in the Electronic Bidders Library](#).

**C-9.1.3 Certification Services.** The Contractor shall determine the requirements necessary for the certification of systems and or components by interpreting the NASA requirements documents and applicable national codes and standards. The Contractor shall be responsible for determining what equipment needs recertification and how best to achieve this with minimum cost.

**C-9.1.4 Certification Tasks.** For each specific certification task, the Contractor shall; review all related existing documentation, generate new drawings if required, make all necessary preparations for inspection, perform all visual and non-destructive examinations, conduct all engineering evaluations, develop risk assessment documentation, develop a statement of work for repairs, and upon completion of the repairs, review and approve all supporting documentation involved with the repairs. The Contractor shall use qualified engineers and technicians in the performance of certification work. There are five major steps used in the certification process at GRC, they are outlined below.

**C-9.1.4.1 Documentation retrieval and review.** The Contractor shall gather existing documentation (or create new documentation in some cases) and other information that is necessary in performing the certification to the current standards. These documents shall include, but are not limited to, the design drawings, materials identification, fabrication information, NDE records, code/design calculations and engineering analysis, code certification data, etc. The Contractor shall establish appropriate recertification files and PSD/CMMS data to provide a permanent recertification record that includes all follow-on In Service Inspection (ISI) requirements.

**C-9.1.4.2 Initial Engineering Assessment.** The Contractor shall review existing documentation to identify and determine the adequacy of the pressure system components with respect to the

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

NASA requirements and current codes and standards. This includes review of maximum allowable working pressure and temperature, remaining life evaluation, etc. In most cases, simple code calculations or evaluations using commercial codes are adequate. However, in some cases a finite element analysis, and/or fatigue and fracture life assessment may be required. The Contractor shall have demonstrated capabilities to perform all type of engineering assessment; and in addition to the above calculations, shall provide relief valve sizing calculations and piping system flexibility analyses of piping systems, as required.

**C-9.1.4.3 Determination of Conditions and Identification of Defects.** The Contractor shall determine the best suitable method to evaluate the current condition of the pressure systems and components based on the code requirements, risk assessments, and cost considerations. This will require review of past operating history, operating conditions, understanding of possible damage mechanisms and review of past in service inspection records. The Contractor shall, based on this evaluation, determine and specify non-destructive examination (NDE) requirements for systems and components.

**C-9.1.4.4 NDE Evaluation.** The contractor shall perform NDE based on the above determination and document all findings. The Contractor shall be capable of providing all types of NDE testing, including visual examination, liquid penetrant examination, magnetic particle examination, radiographic examination, ultrasonic examination, ultrasonic thickness testing, eddy current inspection, hardness testing, acoustic emission examination, positive material identification and replication testing.

**C-9.1.4.5 Final Engineering, Evaluation and Recommendations.** The Contractor shall, based on the results of the NDE evaluation, determine the current condition of the pressure system and all of its components and shall update all preliminary calculations to reflect the current conditions. The Contractor shall establish required corrective actions (repairs), depth and schedule of future in-service inspections (ISI), re-certification schedule, operating restrictions if any and re-rating or de-rating required prior to releasing the system for operation. In many cases, there are choices between making modifications and performing detailed engineering evaluation using ASME section VIII, Div II and finite element analysis. The contractor shall make the recommendation.

**C-9.1.4.6 Certification Report.** The Contractor shall prepare final certification reports documenting results of all the steps outlined above. In addition, the Contractor shall establish risk assessment code determinations based on [NASA standard 8719.17, see Section C-2.1.4.6 in the Electronic Bidders Library](#), risk assessment procedure. The Contractor shall provide the COR a completed Certification Report thirty (30) calendar days after the task completion.

**C-9.1.5 In-Service Inspection.** The Contractor shall perform scheduled inspections in accordance with in-service inspection requirements identified in the data books, PSD, and/or CMMS for those pressure systems, vessels, and components that have been certified and are currently being used. The Contractor shall include post inspection reports and documentation to reflect inspection completion and recommended future inspection actions and requirements. The Contractor shall update as necessary the data books, databases, and drawings.

**C-9.1.6 Database Maintenance and Updates.** The Contractor shall identify systems and components through tagging, bar coding, and documentation utilizing PSD and CMMS. The Contractor shall document all recertification work, results, and recommendations in recertification data books, the PSD, and/or the CMMS. The Contractor shall complete all documentation updates thirty (30) calendar days after the task is completed.

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

**C-9.1.7 Certification Repairs and Analyses.** The Contractor shall have capabilities to make required modifications to existing PV/S and make engineering assessments of the modified PV/S. The Contractor may use in-house staff or outside qualified (sub)contractors as appropriate. Government approval is required before any repairs are done. The Contractor shall follow all FAR requirements when subcontracting repair efforts; as a minimum the Contractor shall acquire three independent bids when the cost of the repairs are expected to exceed \$3,000. The Contractor shall oversee, manage and perform all applicable assessments and analysis on all repair efforts that they implement. The Contractor shall ensure all modifications meet the current code requirements and all modifications be made using code certified welders, welding procedures and NASA safety procedures. The Government reserves the right to make repairs using other contractors. When this happens the Contractor shall not have any involvement or responsibility in these repairs except for final inspection and documenting into the PSD.

### **C-9.2. Maintenance and Repair**

**C-9.2.1 General Scope of Work for Maintenance and Repair.** Various gases and cryogenic liquids including, but not limited to, nitrogen, hydrogen, oxygen, methane helium and argon are delivered to GRC by others and stored in pressure vessels and cryogenic dewars. Distribution of these fluids to various test cells and research facilities is provided by piping systems and other components. Day-to day operations, watch standing, and transfers of medium to and from stationary and mobile high pressure gas and cryogenics systems is done by others and is NOT part of this Contract. However, small transfers of medium for maintenance purposes are required. All maintenance and repairs to these systems are part of this Contract. Cryogenic components may include, but are not limited to: piping and piping systems, pressure systems and vessels, tanks, tubers, vacuum jacketed lines, flex hoses, dewars, gages, regulators, relief valves, valves, transducers, and all other related component, including related Central Process System components, and that may be indicated on functional Process and Instrumentation Drawings (P&IDs). The contractor shall also be responsible for engineering minor solutions addressing day-to day operations and maintenance anomalies and for minor system upgrades.

**C-9.2.2. Preventative Maintenance (PM) & Repair Requirements.** The Contractor shall perform preventive maintenance, programmed maintenance, inspections, and calibrations on all Pressure Vessels and Systems and Cryogenic components and equipment listed in the CMMS and the PSD. The list of Preventative Maintenance Tasks covered under the span of this Contract is located in [Section J Attachment D](#) and in the Technical Reference Library. The Contractor shall as part of its own quality assurance program, randomly inspect the quality of work it performs on at least 10% of the PM tasks it completes per month.

**C-9.2.3 PM Scheduling and Documentation.** The contractor shall use the Government's CMMS in scheduling and documenting their maintenance and repair activities. The Contractor shall document all pertinent task related data, including the names of the individuals who performed the activity and their labor hours for each task in the CMMS. The Contractor shall update the CMMS within seven days upon completion of any task, or as necessary.

**C-9.2.4 Preventative Maintenance Procedures.** PM procedures are defined in the Work Instructions resident in Computerized Maintenance Management System (CMMS), and provided for reference in the Technical Reference Library. The Contractor shall use CMMS to manage its PM program. The Contractor activities shall include updating records, procedures, instruction codes, nameplate data, scheduling, and recommending improvements to GRC's PM program. The data

## CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK

entered in CMMS becomes the property of the Government. Samples of PM Work Instructions are attached in [Section C-9.2.4 in the Electronic Bidders Library](#).

**C-9.2.4.1. Inherent Reliability Problems.** The Contractor shall identify and report to the COR any inherent reliability problems, ineffective maintenance requirements, and ineffective work instructions they uncover and shall make recommendations on how to enhance maintenance approaches.

**C-9.2.5 Maintenance Standards.** The Contractor shall follow the guidelines set forth in NASA NPD 8831.1E Maintenance and Operations of Institutional and Program Facilities and Related Equipment and NPR 8831.2D Facilities Maintenance Management. The Contractor shall recommend additions, deletions, and modifications to the current maintenance activities to the Government;

**C-9.2.5.1.** All recommendations made by the Contractor shall be cost effective and geared to increase the overall reliability and ensure continuous improvement to the health of the equipment.

**C-9.2.5.2.** The Government will provide minimal preventative maintenance procedures which will be available in the Technical Reference Library and otherwise will be listed in the Government's Computerized Maintenance Management System (CMMS).

**C-9.2.5.3** A copy of NASA NPD 8831.1E Maintenance and Operations of Institutional and Program Facilities and Related Equipment (Revalidated June 16, 2008) can be found in [C-7.2.5.3 \(A\) in the Electronic Bidders Library](#) and a copy of NASA NPR 8831.2E Facilities Maintenance and Operations Management can be found in [C-9.2.5.3 \(B\) in the Electronic Bidders Library](#) and in the Technical Reference Library.

**C-9.2.6. Scheduling of Preventive Maintenance Activities.** The Contractor shall plan and schedule maintenance work to assure that materials, labor, and equipment are available to complete requirements within the specified time limits and in conformance with established quality standards. The Contractor shall schedule PM, as well as all other types of maintenance and repair work, in such a way as to minimize the impact on the end user. The Contractor shall not perform scheduled maintenance on overtime without approval from the COR. The Contractor shall document a completion date for all PM work on the monthly PM Work Schedule Report and shall complete all scheduled PM's during the period specified in the work order.

**C-9.2.6.1 Monthly Preventative Maintenance Work Schedule Report.** The Contractor shall provide to the COR a Monthly PM Work Schedule Report, on or about the 20<sup>th</sup> of each month, that details all Preventive Maintenance tasks completed in the previous month, all backlog PM tasks, and all the PM tasks scheduled for the upcoming month.

**C-9.2.7 Scheduling Unplanned Maintenance and Repairs.** Unplanned maintenance and repair are equipment problems or malfunctions that occurs unexpectedly during the course of the day that require immediate attention by the Contractor to ensure equipment availability to meet the research and test schedule.

**C-9.2.7.1.** The Contractor shall plan and schedule this unexpected work to assure that materials, labor, and equipment are available to complete repairs within the specified time limits and in conformance with established quality standards.

**C-9.2.7.2.** The Contractor shall schedule work to minimize interference with the normal occurrence of Government business and mission.



## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

**C-9.2.8 Cryogenic Systems Corrective Maintenance and Repair (CSCMR).** CSCMR is inherent to equipment and systems maintenance. It includes work identified by the Contractor, or the Government, during the performance of normal maintenance and repair work activities, as necessary to correct problems that would interfere with scheduled operations or to prevent injury to people, equipment or the environment. The Contractor shall inform the COR and other applicable Government personnel when a problem has been identified and corrective action planned. The Contractor shall perform the CSCMR Work Orders on cryogenic systems as defined by the government. These tasks shall include, but are not limited to, material purchases and installations. The Contractor shall create a new work order identifying any CSCMR work they discover utilizing the CMMS.

**C-9.2.9 Confined Space Entry Requirements.** The Contractor shall follow all NASA, GRC and OSHA confined space entry regulations and prepare confined spaces for entry by others.

**C-9.2.10 Relief Valve Testing.** The Contractor shall maintain and operate with appropriately qualified staff a relief valve testing station provided by the Government to perform relief valve certifications, including code stamped certifications, and flex hose certifications. The contractor shall operate the Glenn Research Center Relief Valve testing and repair shop to ASME Section VIII, Div. I, Para. NB-23. Certification requirements shall include, but are not limited to, relief valve removal, testing, repair, reinstallation, documentation and updating of the PSD. The Contractor shall maintain, inspect, repair, recondition, supply, replace, install, modify, test, and calibrate relief valves and high-pressure hoses. As of the creation of this SOW the testing station is not operational, therefore a historical work load has not been established. The Contractor may or may not have to acquire additional staff to perform this function if and when additional Government funding becomes available.

**C-9.2.11 Tube Trailer Recertification.** The Contractor shall manage the refurbishment process of tube trailers to meet the applicable Department of Transportation (DOT) requirements for tube trailer recertification. The Government anticipates approximately six (6) tube trailers per year will require testing and refurbishment.

### **C-9.3 Personnel Requirements**

**C-9.3.1 General Personnel Requirements.** Safety is of paramount importance in all issues related to the activities covered under this SOW. Due to high pressure and/or temperatures, as well as cryogenic conditions, knowledge of, and strict adherence to, NASA, GRC, ASME, ANSI, DOT and other applicable national codes and standards is imperative. The Contractor shall ensure that personnel performing this work possess a comprehensive understanding of their duties and all applicable codes and standards. The Contract shall provide a report to the COR that provides proof of certification and qualifications of their employees who perform PV/S certification work. The proof of certification and qualifications report is due 15 days after Contract start date, then on the 1<sup>st</sup> day of every September and March. See [Section J Attachment E](#) for further general personnel requirements details. The following specialized skills will be required to perform pressure system certification.

**C-9.3.1.1 Key Personnel.** Key Personnel are defined as the group of individuals responsible for the management of the contract. The Contractor's key personnel shall be; full time employees, solely dedicated to the implementation of this contract, and be permanently stationed at GRC.

**C-9.3.1.2. Critical Personnel.** Critical personnel are defined as the technical individuals required for the successful technical execution of the task. The Contractor's critical personnel

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

shall be; full time employees, solely dedicated to the implementation of this contract, and be permanently stationed at GRC.

### **C-9.3.2 Pressure Systems Engineers (PSE)**

**C-9.3.2.1 Chief Principal Pressure System Engineer (PSE).** Completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in overseeing and managing fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. The position of Chief Principal PSE does not require that the individual be a state registered professional engineer.

**C-9.3.2.2 Principal PSE.** Completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. The Contractor's Principal PSEs shall be a registered Professional Engineers.

**C-9.3.2.3 Senior PSE.** Completion of a ABET accredited engineering degree, requiring four or more years of full-time study. Experienced in fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. Senior PSEs should be registered Professional Engineers.

**C-9.3.2.4 PSE.** Completion of a ABET accredited engineering degree, requiring four or more years of full-time study, some experience in fitness-for-service analysis, inspection and failure analysis, or design, evaluation, construction, repair, and operation of pressure vessels, piping and tanks in the cryogenic/gas, aerospace, chemical, nuclear, refining and/or petrochemical industry. Formal classroom training in the following courses is also required: ASME B&PV Section VIII Div 1 and 2, ASME B31.3, ASME / NBIC NB-23, API RP-579, and API RP-520.

### **C-9.3.3 Inspectors, Examiners and Draftsman**

**C-9.3.3.1 NDE Level III Technician.** Completion of related classroom training in accordance with ASNT SNT-TC-1A, plus experience in the inspection and examination of pressure vessels, piping and tanks in the cryogenic/gas aerospace, chemical, nuclear, refining and/or petrochemical industry; and ASNT certification to perform visual, leak testing, liquid penetrant, magnetic particle, radiography, ultrasonic shearwave, and ultrasonic thickness testing.

**C-9.3.3.2 Senior NDE Technician (NDE Level II).** Completion of related classroom training in accordance with ASNT SNT-TC-1A, plus experience in the inspection and examination of pressure vessels, piping and tanks in the cryogenic/gas aerospace, chemical, nuclear, refining and/or petrochemical industry; and ASNT certification to perform visual, leak testing, liquid penetrant, magnetic particle, radiography, ultrasonic shearwave, and ultrasonic thickness testing.

**C-9.3.3.3 NDE Technician (Examiners).** Completion of related classroom training and work experience in accordance with ASNT SNT-TC-1A, as detailed in the chart in [Section J Attachment F](#).



**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C.9.3.3.4 Draftsman DRAFTER/CAD OPERATOR IV** This person works closely with design with Pressure Systems engineers and Technicians preparing drawings or computer models of Pressure Systems and components found throughout GRC's Lewis Field and Plumbrook Station. See Attachment E in Section J for further details.

**C-9.3.4 Qualification of Cryogenic Personnel**

**C-9.3.4.1 General Qualifications of Cryogenic Personnel.** The Contractor shall ensure that all cryogenic technicians have the minimum qualifications as defined by the Department of Labor (DOL) as an engineering technician. Cryogenic Technicians are classified according to skill level and ability in three classifications, as described below. As cryogenics is a specialized field, new personnel are employed primarily as a Cryogenic Technician I (Cryo Tech I) unless prior experience dictates otherwise. A Cryo Tech I may only advance upon successful completion of the conditions for advancement to Tech II.

**C-9.3.4.2 Cryogenic Work Lead (CWL)** Supervises the maintenance and operation of stationary and mobile high pressure gas and cryogenic systems that provide hydrogen, oxygen, helium, nitrogen, argon, methane and air in both liquid and gas form to users in the Glenn research community.

**C-9.3.4.2.1** This is the third in a series of three classifications. The CWL is distinguished from the Technician I and Cryogenic Technician II by supervisory and administrative responsibilities in support of the Glenn Research Center Cryogenics Program. The Cryogenic Work Lead has the responsibility of managing cryogenic and high pressure systems equipment maintenance and repair. The CWL reviews and makes recommendations for the safe filling and transferring procedures for mobile and stationary dewars and other cryogenic and high pressure gas system equipment. The CWL works with the NASA task managers, facility managers, building managers, responsible engineers, the Pressure Systems Office, and the Process Systems Safety Committee to correct discrepancies with cryogenic and high pressure gas systems, components, and equipment.

**C-9.3.4.2.2 Knowledge, Skills and Abilities:** The CWL shall have:

- Intimate knowledge of safety concerns associated with cryogenic and high pressure gas systems.
- Intimate knowledge of mobile and stationary cryogenic and high pressure gas systems.
- Knowledge of the physical properties of cryogenic liquids and gases.
- Knowledge of mechanical and electrical principles.
- Knowledge of codes and regulations as they pertain to cryogenic and high pressure gas systems.
- Skilled in the installation, adjustment and repair of mechanical and electrical equipment.
- Skilled in reading, understanding and red-lining piping and instrumentation diagrams (P&IDs) of cryogenic and high pressure gas systems.
- Skilled in supervising and coordinating the work of others.
- Ability to communicate effectively.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-9.3.4.3 Cryogenic Tech II (CT2)** Performs maintenance and operation of stationary and mobile high pressure gas and cryogenics systems that provide hydrogen, oxygen, helium, nitrogen, argon, methane and air in both liquid and gas form to users in the Glenn research community.

**C-9.3.4.3.1** This is the second in a series of three classifications. The CT2 is distinguished from the Cryogenic Technician I, by an advanced experience level over that of the Cryogenic Technician I classification. The Cryogenic Technician II has the responsibility of maintaining and repairing cryogenic and high pressure gas systems and equipment. The CT2 reviews and makes recommendations for the safe filling and transferring procedures for mobile and stationary dewars and other cryogenic and high pressure gas equipment.

**C-9.3.4.3.2 Knowledge, Skills and Abilities:** The CT2 shall have:

- Intimate knowledge of the safety concerns associated with cryogenic and high pressure gas systems.
- Intimate knowledge of mobile and stationary cryogenic and high pressure gas systems.
- Knowledge of the physical properties of cryogenic liquids and gases.
- Knowledge of mechanical and electrical principles.
- Knowledge of codes and regulations as they pertain to cryogenic and high pressure gas systems.
- Skilled in the installation, adjustment and repair of mechanical and electrical equipment.
- Skilled in reading, understanding and red-lining piping and instrumentation diagrams (P&IDs) of cryogenic and high pressure gas systems.

**C-9.3.4.4 Cryogenic Tech I (CT1)** A CT1 performs maintenance and operation of stationary and mobile high pressure gas and cryogenics systems that provide hydrogen, oxygen, helium, nitrogen, argon, methane and air in both liquid and gas form to users in the Glenn research community.

**C-9.3.4.4.1** This is the first in a series of three classifications. The CT1 is distinguished from the Cryogenics Technician II, and Cryogenics Work Lead by an entry level type position for experienced mechanics; training in the specialized cryogenics field. The Cryogenics Technician I has the responsibility of maintaining and repairing cryogenic/high pressure gas systems and equipment.

**C-9.3.4.4.2 Knowledge, Skills and Abilities:** The CT1 shall have:

- Basic knowledge of the safety concerns associated with cryogenic and high pressure gas systems.
- Basic knowledge of mobile and stationary cryogenic and high pressure gas systems.
- Basic Knowledge of the physical properties of cryogenic liquids and gases.
- Knowledge of mechanical and electrical principles.
- Skilled in the installation, adjustment and repair mechanical and electrical equipment and compressors.
- Skilled in reading and understanding piping and instrumentation diagrams (P&IDs) of high pressure gas and cryogenic systems.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-10. HEALTH and SAFETY PLAN (HASP) and Reports**

**C-10.1. Health and Safety.** The Contractor shall provide all safety and occupational health equipment including Personnel Protective Equipment (PPE) to perform the work specified in this contract. All work shall be conducted in a safe manner and shall comply with all OSHA and NASA requirements. The contractor shall demonstrate proactive safety practices.

**C-10.2. Health and Safety Plan.** The Contractor shall provide a Corporate Health and Safety Plan detailing all corporate policies and procedures that will insure the safety and occupational health of all of the Contractor's employee as well as the safeguard of all NASA personnel and other NASA Contractors that will interact, as required, with this Contractor as it carries out the requirements of this PWS. The Corporate Health and Safety Plan shall be valid for a period not to exceed 60 calendar days from the contract award date and shall cover all work required by this PWS.

**C-10.2.1. Site Specific Health and Safety Plan.** Only the successful offeror will be required to submit a Site-specific Health and Safety Plan (HASP). The Contractor shall provide their Health and Safety Plan to the Contracting Officer sixty (60) calendar days after Contract Award date. The Contractor's HASP must be approved by the Contracting Officer and the GRC Safety, Health and Environmental Division (SHED). Elements required within a Site Specific Health and Safety Plan are listed in GRC Safety Manual which is in the Technical Reference Library.

**C-10.3. Inspections.** The Contractor's workspace may be inspected periodically for OSHA and NASA violations. Abatement of Contractor violations will be the responsibility of the Contractor as determined by the Government. The Contractor shall provide assistance to applicable NASA and GRC organizations and the OSHA inspector if a complaint is filed.

**C-10.4. Accidents.** The Contractor shall report accidents, incidents (near misses) and violations in accordance with the appropriate GRC, NASA, and OSHA regulations and instructions.

**C-10.5. Environmental Compliance.**

**C-10.5.1. Environmental Protection and Policies.** The Contractor shall comply with all applicable Federal, State, and local laws, and with the regulations and standards listed in the GRC Environmental Programs Manual. All environmental protection matters shall be coordinated with the COR and representative from GRC Safety, Health, and Environmental Division (SHED). Inspection of any of the facilities operated by the Contractor may be accomplished by the Government or individual(s) authorized by the Government, without notice at any time. In the event that a regulatory agency assesses a monetary fine or penalty against the Government for violations which directly result from performance by the Contractor in carrying out their responsibilities under this contract, the Contractor shall reimburse the Government for the amount of that fine or penalty and other related costs incurred by the Government. Any such reimbursement shall be accomplished by a contract credit. The Contractor shall use certified personnel, normally provided by GRC SHED, to clean up any hazardous waste spills that result from the Contractor's performance. The Contractor shall comply with the instructions of the cognizant GRC SHED with respect to avoidance of conditions which create a nuisance or which may be hazardous to the health and safety of on-site personnel. The Contractor shall observe and adhere to all requirements for handling and storage of combustible supplies, materials, waste, and trash. Any oils and lubricants resulting from work of the Contractor (i.e., PM), including those removed from Government owned equipment, shall be disposed of in accordance with GRC instructions.

**C-10.6. Lockout/Tagout (LO/TO).** The Contractor shall provide all LO/TO service in support of the Contractor's own work. In addition, the Contractor shall provide LO/TO service on CPS equipment for work done by others, including the Government and other Contractors. The Contractor LO/TO procedures must conform to the procedures specified in the Glenn Safety Manual and comply with OSHA and all other applicable regulatory policies.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-10.6.1. Qualified LO/TO Personnel.** Within fifteen (15) calendar days after Contract Start Date, and as requested by the COR, the Contractor shall provide the COR a listing of all employees and their LO/TO roles, responsibilities, qualification and titles, including but not limited to: Area Supervisor(s), Authorized Employee(s), and personnel qualified to perform electrical high and/or low voltage, or mechanical switching and energy isolation of systems related to the CPS.

**C-10.7. Software Lockout/Tagout (LO/TO).** The Contractor shall place and remove operator console “screen tags” on all components associated within their area of control when LO/TO activities dictate. The Contractor shall “Out-of Service” (OOS) all points that provide nuisance alarms to the Operators.

**C-10.8. Confined Space Entry Requirements.** The Contractor shall follow all NASA, GRC and OSHA confined space entry regulations and prepare confined spaces for entry by others.

**C-10.9. System Outages.**

**C-10.9.1. Planned System Outages.** When planned maintenance or repair requires a break or reduction in services, the Contractor shall make the following notifications for all activities performed under this contract requiring system or building outages, the Contractor shall provide in writing, at least five (5) working days advance, notice to the COR and the Central Air Dispatcher (CAD) along with the affected Building Manager, System Manager, Project Manager (if applicable) and Facility Manager. A list of Facility Managers (FM) or customers for each facility will be provided by the Government upon request. Customer notification shall include the length of time and type of work to be performed. Should work progress temporarily halt before job completion, the Contractor shall provide the customer with the reason for delay and the projected date or time they shall return to complete the work. The COR will make every attempt to approve the requested outage; however, as a general rule priority is given to scheduled research activities. The Contractor shall fully cooperate with other contractors and Government employees and shall carefully adapt scheduling and performance of work under this contract to accommodate the work by others.

**C-10.9.2. Area Clearance.** The Contractor shall execute an “Area Clearance” request that shall provide, as a minimum, the following specifications or information to the affected individuals: the equipment or system involved; reason for the outage; date and time the Contractor would like the outage to occur; and an estimate of when normal services are to be resumed. A sample Area Clearance is shown in Section J-C-10.9.2 and in the Technical Reference Library.

**C-10.10. Hardwire Shutdown Verifications & Calibrations.** The Contractor shall verify the Hardwire Shutdowns and Calibrations on any system or piece of equipment which has been taken out of service for major repair or rehabilitation or has been replaced due to component failure or wear.

**C-10.11. Safety Permit Documentation and Support.** The Contractor shall be the requester for the various safety permits. Within fourteen (14) calendar days after the start of the contract, the Contractor shall review and update the information in all CPS related Safety permits. A list of CPS related Safety Permits is provided in Section J-C-7.11

**C-10 .11.1 Annual Documentation.** The Contractor shall prepare and submit annual documentation necessary for submittal to the NASA GRC Electrical Applications and/or Process Systems Safety Committees as part of the permit renewal request process. An example is provided in Section J-C-7.11.1. This shall include notification of all procedural changes being considered, reporting on significant irregularities that impact safety, listing of qualified operators, hosting and conducting walk-through inspections by the safety committee membership, answering specific questions posed by safety committee members verbally and in written form.

# **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

## **C.11 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS)**

**C-11.1. General.** The Contractor shall utilize the GRC Computerized Maintenance Management System (CMMS) for all asset inventory management, asset history management, and work control (scheduling, tracking, field observation logging, etc.) activities associated with this contract.

GRC's CMMS is Maximo Asset Management 7.5, a product of IBM, Incorporated. GRC will provide controlled access to Maximo, and reserves the right to upgrade the version of Maximo at any time during the life of this contract. Since the Maximo software used by GRC has been customized from the vendor's standard version, local training will be provided to the Contractor's personnel by the Government at no cost to the Contractor.

Wherever the term CMMS is used in this SOW, it refers to GRC's Maximo software. The Contractor is prohibited from using an electronic interface between any other CMMS system and the GRC Maximo system for asset & work order management purposes. Data may be exported from the GRC Maximo system and uploaded to external business systems, purchasing systems, and/or inventory management systems owned by the Contractor.

This Chapter describes the current configuration and the established processes and procedures used for the GRC Maximo System. This description is not meant to restrict future innovations that may be recommended by the Contractor. It should be noted that multiple other maintenance contractors at GRC are also using the Maximo System, so any modifications and changes must be analyzed and tested to ensure that others are not adversely impacted.

**C-11.2. CMMS Definitions, Processes & Module Information.** Basic definitions and terminology for the GRC Maximo CMMS are listed in Attachment J-C.X.X. CMMS process flowcharts are provided in Attachment J-C.X.X. The GRC Maximo System Module Information is provided in Attachment J-C.X.X.

**C-11.3. CMMS Security Group and Work Group Structures.** At GRC, there is a CMMS Security Group and a Work Group Structure that establishes what Maximo users can and cannot do within the database system. By definition, a Security Group identifies which persons can enter specific types of data into Maximo and a Work Group identifies specific crafts and limits persons as to what type of data can be viewed in Maximo.

This description of the CMMS Security and Work Group Structures is intended to convey how the GRC Maximo System is currently configured and not intended to direct Offerors on how to structure their management organization. If required, the Contractor may suggest that a Security Group be and/or the addition of Work Groups to the GRC Maximo Administrator.

**C-11.3.1 Security Groups.** As indicated in Section C.X.X, a selected number of Contractor employees will be furnished with an ACES computer seat and a NDC domain account. Anyone at GRC with an NDC account can initiate a work order without having a Maximo seat license. However, only licensed users can add or view other data in Maximo.

Licensed users are divided into two categories: those that need "read-only" access to work orders and other data and those that need the ability to add or change data. Depending on the specific needs, licensed users are assigned to one of twelve (12) Institutional Security Groups as listed in Attachment J-C.9.3. Seven (7) Security Groups are currently reserved for Government employees, and five (5) Security Groups are currently assigned to Contractor personnel. Those assigned to Contractor personnel are Functional Area Managers, Read-Only Guests, Work Controllers/Schedulers, Work

## **CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM) PRELIMINARY DRAFT STATEMENT OF WORK**

Group Leads, and Work Group Technicians.

**C-11.3.2 Work Groups.** For the GRC Maximo system, there are fifteen (15) Institutional Work Groups as listed in Attachment J-C.9.4. Three (3) Work Groups are reserved for Government employees, and twelve (12) Work Groups are assigned to Contractor personnel.

Each Work Group assigned to the Contractor shall have a Work Group Lead (single individual may be assigned to multiple Work Groups). The Lead will have the ability to view, add, or change data only for work orders assigned to their Work Group. In addition, each Work Group assigned to the Contractor shall have Work Group Technicians. The Technician will only be able to view, add, or change data only for work orders to which they are assigned.

**C-11.3.3 Other Data Restrictions.** The following are other Maximo data restrictions:

**C-11.3.3.1** The Contractor will not be able to view work orders that are in Waiting for Approval (WAPPR), Waiting for Plan (WPLAN), or Plan Complete (PLANCOMP) status until the status is changed by Government personnel.

**C-11.3.3.2** Work Controllers & Schedulers will not be able to cancel a work order (can only be accomplished by a Functional Area Administrator). However, the Work Controller & Scheduler can place a work order in Rework (REWORK), Waiting For Estimate (WEST), Estimate Complete (ESTCOMP), In Progress (INPRG) or Assigned (ASSGND) status.

**C-11.4 Asset Organization.** The assets at GRC are organized according to “Site” and “Functional Area.” The two available Sites are “LF” for Lewis Field and “PBS” for Plum Brook Station. The Function Areas are as follows:

IN – Institutional  
TS – Test Support  
PS – Pressure Systems  
CP – Central Process Systems

As an example, within the GRC Maximo Asset Module, all Lewis Field test support assets would be organized under the Site “LF” and under the Functional Area “TS.”

For this contract, the majority of the assets to maintained would reside under the Site “LF” and the Functional Areas “CP” and “PS.”

**C-11.5 Pressure Systems Database.** Blah, blah, blah.....

**C-11.6 Mobile Technology.** The GRC Maximo system is located within the Center’s firewall and accessible only with a NDC domain account. Although GRC has wireless IT capability throughout the Lewis Field Campus, mobile technology is currently not being utilized to support the institutional operations and maintenance contract. Options for mobile technology are currently being evaluated by the Government.

Once the Government and the Contractor mutually agree on candidate hardware, a plan will be established and the contract will be modified to include the testing and implementation of mobile technology.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-11.7 Required CMMS Input Information.** Both GRC O&M personnel and Contractor personnel have responsibilities to enter data into the GRC Maximo system and to monitor trends and produce reports. The following are the CMMS responsibilities for various types of work.

**C-11.7.1 Maximo Assets Module.** The addition of new assets and the decommissioning of existing assets in Maximo is the responsibility of the Government. However, the Contractor shall be responsible for providing asset data and/or support to the Government POC.

**C-11.7.1.1 Asset Inventory.** The Contractor shall partner with the Government to manage the GRC Lewis Field asset inventory. This must be accomplished through the field verification of assets during the standard PM/PGM cycles to capture any anomalies or omissions. The Contractor shall subsequently update the Maximo Assets Module to reflect the findings.

**C-11.7.1.2 New Building/System Construction and/or Major Rehabilitation.** New building or system construction and major rehabilitation of existing buildings will result in the addition and/or decommissioning of multiple assets. In these cases, the construction contractor (not part of this contract) will be required to provide asset information to the Government POC for input into Maximo.

At a point between 60 and 70% construction completion (prior to wall and ceiling installation), an IDIQ SR will be generated to this contract. The Contractor shall walk the site and physically tag all assets identified by the Government POC.

**C-11.7.1.3 New Assets Installed Under This Contract.** If the Contractor installs a new asset or removes an existing asset as part of this contract, the following information shall be provided to the Government POC in an electronic format (EXCEL, WORD, etc.) prior to the close-out of the work order:

- C-11.7.1.3.1 Description of asset and assignment of the discipline code (i.e., HVAC, PS, LELC, etc.)
- C-11.7.1.3.1 Manufacturer
- C-11.7.1.3.2 Vendor information
- C-11.7.1.3.3 Model Number
- C-11.7.1.3.4 Serial Number (must be verified by Contractor Personnel upon delivery)
- C-11.7.1.3.5 Acquired date
- C-11.7.1.3.6 Installed date
- C-11.7.1.3.7 Purchase price (equipment cost)
- C-11.7.1.3.8 Operating status (operating, not ready, or decommissioned)
- C-11.7.1.3.9 Asset Classification Code
- C-11.7.1.3.10 Location of asset (building number, floor, room)
- C-11.7.1.3.11 Additional location information (i.e., above ceiling, next to column line, etc.)
- C-11.7.1.3.12 Digital picture (JPEG , etc.) of asset in its installed location
- C-11.7.1.3.13 Scanned information such as O&M manual, parts list, and consumables (PDF or JPEG)
- C-11.7.1.3.14 Run-to-failure status (yes/no)
- C-11.7.1.3.15 Reference drawing numbers (if applicable)
- C-11.7.1.3.16 Collateral/Non-collateral equipment indication
- C-11.7.1.3.17 Parent asset information (if applicable)
- C-11.7.1.3.18 NASA Condition Code (numerical value from 1 to 5)
- C-11.7.1.3.19 Warranty information

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

The Contractor will receive an official asset number and tag from the Government POC and shall be responsible for installing the tag in a visible location on the asset. For assets associated with official GRC Pressure Systems, the Contractor will receive a Pressure Systems Database (PSD) system code from the Government POC.

The Contractor shall provide a semi-annual report of all new assets that they install and any existing assets that they decommission under this contract.

**C-11.7.2 Maximo Work Order Module, PM/PGM/PT&I Work.** Only the Government will have the ability to add, delete, or change PMs, PGMs, or PT&I activities, alter the frequencies, and modify work instructions in Maximo. However, as described in Section C.13 Reliability-Centered Maintenance (RCM) Program, the Contractor is encouraged to recommend changes to the recurring maintenance activities. Once these changes are mutually agreed upon by the Government and the Contractor, the Government will make the necessary changes in Maximo.

At GRC, a PM/PGM/PT&I can be assigned to an Asset (specific piece of equipment), a Location (building identifier), or a Route (when numerous assets are bundled together such as smoke detectors, fire extinguishers, fan coil units, etc.). The Government's goal is to work with the Contractor to assign these activities to Locations and Routes as much as possible in order to minimize the number of work orders.

The Contractor shall follow the procedures below for entering Maximo data for PM/PGM/PT&I work:

**C-11.7.2.1** The Contractor's WCO shall run a query in Maximo approximately seven (7) days prior to the end of each month to determine what PMs, PGMs, and PT&Is are scheduled for the following month. Based on this query, the Contractor shall generate the Work Orders accordingly and populate the Work Order Type.

**C-11.7.2.2** Once the Work Order is generated, the Target Start Date will be automatically populated in Maximo. By definition, the Target Dates are the Customer's desired dates and are not the committed dates identified by the Contractor.

**C-11.7.2.3** The Contractor's WCO, with the Government's approval, shall populate the Target Finish Date, which will account for the allowable time-frame tolerance for finishing the work, in accordance with the requirements specified in the SOW. In addition, the WCO shall populate the financial WBS number and appropriate Work Group to assign the Work Group Lead.

**C-11.7.2.4** Upon receipt of the Work Order, the Work Group Lead shall enter the Work Group Technicians assigned to the task, the Scheduled Start Date and the Scheduled Finish Date (in accordance with the requirements specified in this SOW).

**C-11.7.2.5** If a site-specific safety plan is required, the Contractor's Safety & Health representative shall check the Job Hazard Analysis (JHA) box, and attach a WORD, PDF, or IFM version of the plan to the Work Order.

**C-11.7.2.6** Once the Work Order is started, the Work Group Technician, under the Work Order Tab, shall enter the Actual Start Date.

**C-11.7.2.7** Once the work has started, the Work Group Technician, under the Actuals Tab, shall



**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours). The Work Group Technician shall also populate the Work Log Tab with comments including verification of Asset bar code, assessment of task validity and frequency, safety concerns, needs for special tools or manufacturer's information, Asset data corrections, field observations, work that was accomplished, issues that occur, etc.

As mentioned above, GRC plans to implement the use of mobile technology to help facilitate the capturing of field comments at some point during this contract. In the interim, the Contractor shall ensure that field comments are captured and uploaded into Maximo.

**C-11.7.2.8** The Work Group Technician shall either assign a Facility Condition Index (FCI) or update the FCI of the equipment being maintained (if applicable). This information is entered in the Asset Module, Asset Tab as a numerical value between 1 and 5.

**C-11.7.2.9** At the completion of the work, the Work Group Technician shall change the Status Field to Work Complete for their individual task in the Actuals Tab.

**C-11.7.2.10** The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

**C-11.7.2.11** The GRC FOS will perform surveillance on approximately 10% of the completed PM/PGM/PT&I work orders, and generate an associated evaluation. If the GRC FOS determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the GRC FOS determines that the work is complete, the Work Order will be closed.

**C-11.7.2.12** If equipment malfunctions or system issues are identified during the execution of a preventative maintenance activity, the Work Group Lead shall issue a TC in accordance with the procedures listed below.

**C-11.7.3** Maximo Work Order Module, TC Work. For TCs, Customers will generate a Maximo work request by either calling or e-mailing the WRO or by accessing Maximo directly through the GRC Intranet, Facilities Division Website. TCs can also be generated by the Contractor's Work Control Lead following the identification of a problem during a routine maintenance activity.

**C-11.7.3.1** The Customer will enter the Target Finish Date.

**C-11.7.3.2** The GRC WRO will determine if the Customer's work request is a TC, populate the Work Order Type, and change the Status to Approved. The WRO will then go to the Request Priority box and select Emergency, Urgent, or Routine from the drop-down menu. Lastly, the WRO will enter the TC financial WBS number, the FOS, the POC (Customer's name), the Work Group (LF-IN-CONT-WKCTRL), and populate the Scheduled Finish Date.

**C-11.7.3.3** The GRC WRO will send the TC Work Order directly to the Contractor's WCO. The WCO then change the Work Group in accordance with the appropriate trade. This directs the TC to the appropriate Work Group Lead.

**C-11.7.3.4** Upon receipt of the TC, the Contractor's Work Group Lead shall enter the Work Group Technicians assigned to the task, and the Scheduled Start Date.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-11.7.3.5** Upon review of the TC and the associated field conditions, if the Work Group Lead suspects that the cost for the work will exceed the TC cost threshold (see Section C.10.4), the Work Group Lead shall halt the work and follow the procedures outlined in Section C.10.6 to transition the TC Work Order to a Repair.

**C-11.7.3.6** If a site-specific safety plan is required for the TC, the Contractor's Safety & Health representative shall check the Job Hazard Analysis (JHA) box, and attach a WORD, PDF, or IFM version of the plan to the Work Order.

**C-11.7.3.7** Once the Work Order is started, the Work Group Lead, under the Work Order Tab, shall enter the Actual Start Date. The Work Group Technician can enter the Actual Start Date for their assigned portion of the Work Order (not the entire Work Order).

**C-11.7.3.8** Once the work has started, the Work Group Technician, under the Actuals Tab, shall enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours). The Work Group Technician shall also populate the Work Log Tab with comments including verification of Asset bar code, safety concerns, needs for special tools or manufacturer's information, Asset data corrections, field observations, work that was accomplished, issues that occur, etc.

**C-11.7.3.9** If an equipment failure is identified during the TC, under the Failure Reporting Tab, the Work Group Technician shall choose the Failure Class from the drop-down menu, a Problems and Causes from the drop-down menu, and provide a Remedy in the free-form text section in the Work Order.

**C-11.7.3.10** The Work Group Technician shall either assign a Facility Condition Index (FCI) or update the FCI of the equipment being maintained (if applicable). This information is entered in the Asset Module, Asset Tab as a numerical value between 1 and 5.

**C-11.7.3.11** At the completion of the TC work, the Work Group Technician shall change the Status Field to Work Complete for their individual task in the Actuals Tab.

**C-11.7.3.12** The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

**C-11.7.3.13** The Customer will automatically receive a notice that the TC work has been completed, and receive a survey. If the survey has not been completed after thirty (30) days, the FOS can close out the TC Work Order.

**C-11.7.3.14** The GRC COR will perform surveillance on approximately 10% of the completed TC Work Orders, and generate an associated evaluation. If the GRC FOS determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the GRC FOS determines that the work is complete, the Work Order will be closed.

**C-11.7.4** Maximo Work Order Module, MSR Work. For MSR activities, a Customer will generate a Maximo work request by either calling or e-mailing the WRO or by accessing Maximo directly through the GRC Intranet, Facilities Division Website. This work activity is initially considered to be part of the IDIQ portion of the contract.

The Contractor shall follow the procedures below for entering Maximo data for MSR work:

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-11.7.4.1** When the Customer generates the work request, the Reported Date is automatically populated in Maximo. The Customer will also enter the Target Start Date and the Target Finish Date.

**C-11.7.4.2** The Government's WRO will determine the nature of the work request, and populate the Work Order Type and sends the Work Order to the appropriate FOS. At this point, the work is anticipated to be IDIQ work.

**C-11.7.4.3** All IDIQ Work Orders are directed to GRC's Work Order Prioritization Meetings, which are currently held twice per week. Work Orders that receive a high priority are forwarded to appropriate GRC FOS for further action.

**C-11.7.4.4** The GRC COR will change the Work Order status to Waiting for Estimate (WEST), and reassigns the work to the Contractor's WCO by entering the Work Group (LF-IN-CONT-WKCTRL).

**C-11.7.4.5** The Contractor's WCO shall change the Work Group in accordance with the appropriate trade. This directs the Work Order to the appropriate Work Group Lead.

**C-11.7.4.6** Upon receipt of the Work Order, the Work Group Lead will perform a field investigation and determine the approximate cost of the work. If the estimate is less than the MSR cost threshold limit, the Work Group Lead will contact the GRC FOS.

**C-11.7.4.7** The GRC FOS will determine if the Work Order will be changed to an MSR. If so, the FOS will change the SR subtype to Minor, and approve the Work Order to proceed accordingly. The work is now considered to be funded as part of the fixed-price portion of the contract (no longer IDIQ).

**C-11.7.4.8** The GRC FOS will also enter the Scheduled Start Date and the Scheduled Finish Date. The GRC FOS, the Contractor, and the customer will negotiate the Scheduled Finish Date based on material availability and work access restrictions.

**C-11.7.4.9** Upon receipt of the Work Order, the Contractor's Work Group Lead shall enter the Work Group Technicians assigned to the task, the Scheduled Start Date and the Scheduled Finish Date (in accordance with the requirements specified in this SOW).

**C-11.7.4.10** If a site-specific safety plan is required, the Contractor's Safety & Health representative shall check the Job Hazard Analysis (JHA) box, and attach a WORD, PDF, or IFM version of the plan to the Work Order.

**C-11.7.4.11** Once the Work Order is started, the Work Group Technician, under the Work Order Tab, shall enter the Actual Start Date.

**C-11.7.4.12** Once the work has started, the Work Group Technician, under the Actuals Tab, shall enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours). The Technician shall also populate the Work Log Tab with comments (see examples above).

**C-11.7.4.13** At the completion of the work, the Work Group Technician shall change the Status Field to Work Complete for their individual task in the Actuals Tab.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-11.7.4.14** The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

**C-11.7.4.15** The GRC FOS will evaluate the work to determine the completion status. If the GRC FOS determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the GRC FOS determines that the work is complete, the Work Order will be closed and the FOS/Customer will generate a survey.

**C-11.7.5 Maximo Work Order Module, Repair, ROI, and SR Work.** For repairs, ROI and SR activities, a Customer will generate a Maximo work request by either calling or e-mailing the WRO or by accessing Maximo directly through the GRC Intranet, Facilities Division Website. These work activities are considered to be part of the IDIQ portion of the contract.

The Contractor shall follow the procedures below for entering Maximo data for repair, ROI, and SR work:

**C-11.7.5.1** When the Customer generates the work request, the Reported Date is automatically populated in Maximo. The Customer will also enter the Target Start Date and the Target Finish Date.

**C-11.7.5.2** The Government's WRO will determine the nature of the work request, and populate the Work Order Type. The WRO will also enter the financial WBS number, the FOS, and the POC (Customer's name).

**C-11.7.5.3** All IDIQ Work Orders are directed to GRC's Work Order Prioritization Meetings, which are currently held twice per week. Work Orders that receive a high priority are forwarded to appropriate GRC FOS for further action.

**C-11.7.5.4** The GRC FOS will change the Work Order status to Waiting for Estimate (WEST), and reassigns the work to the Contractor's WCO by entering the Work Group (LF-IN-CONT-WKCTRL).

**C-11.7.5.5** The Contractor's WCO shall change the Work Group in accordance with the appropriate trade. This directs the Work Order to the appropriate Work Group Lead.

**C-11.7.5.6** The Work Group Lead, in conjunction with the Contractor's Business Office, shall create a cost estimate for the work. The Contractor shall populate the work fields in the Work Order Module including checking the Estimate Required Box and populating the fields for Estimated Labor Hours, Estimated Labor Costs, Estimated Material Costs, Estimated Service Costs, and the Estimated Total Cost.

**C-11.7.5.7** The Contractor's cost estimate will be evaluated by Government personnel in accordance with the procedures described in Section C.12.4.

**C-11.7.5.8** Once the estimate is approved (now referred to as a fixed-price quote) and funding is obtained, the GRC FOS will change the Work Order status to Approved. The GRC FOS will also enter the Scheduled Start Date (which is the date funding is received) and the Scheduled Finish Date. The GRC FOS, the Contractor, and the customer will negotiate the Scheduled Finish Date based on material availability and work access restrictions.

**C-11.7.5.9** Upon receipt of the Work Order, the Work Group Lead shall enter the Work Group

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

Technicians assigned to the task, the Scheduled Start Date and the Scheduled Finish Date (in accordance with the requirements specified in this SOW).

**C-11.7.5.10** If a site-specific safety plan is required, the Contractor's Safety & Health representative shall check the Job Hazard Analysis (JHA) box, and attach a WORD, PDF, or IFM version of the plan to the Work Order.

**C-11.7.5.11** Once the Work Order is started, the Work Group Technician, under the Work Order Tab, shall enter the Actual Start Date.

**C-11.7.5.12** Once the work has started, the Work Group Technician, under the Actuals Tab, shall enter the Labor Hours (regular hours for which only eight hours can be added per day) and the Premium Pay Hours (for any approved overtime hours). The Technician shall also populate the Work Log Tab with comments (see examples above).

**C-11.7.5.13** If an equipment failure is identified, under the Failure Reporting Tab, the Work Group Technician shall choose the Failure Class from the drop-down menu, a Problems and Causes from the drop-down menu, and provide a Remedy in the free-form text section in the Work Order.

**C-11.7.5.14** The Work Group Technician shall either assign a Facility Condition Index (FCI) or update the FCI of the equipment being maintained (if applicable).

**C-11.7.5.15** At the completion of the work, the Work Group Technician shall change the Status Field to Work Complete for their individual task in the Actuals Tab.

**C-11.7.5.16** The Work Group Lead or the WCO shall enter the Actual Finish Date and change the status of the overall Work Order to Ready Close.

**C-11.7.5.17** The GRC FOS will evaluate the work to determine the completion status. If the GRC FOS determines that the work is not complete, the status will be changed to Rework, and the Work Group Lead will be notified. If the GRC FOS determines that the work is complete, the Work Order will be closed and the FOS/Customer will generate a survey.

**Routine Reports.** The Contractor shall use the CMMS to produce various maintenance reports. The type and number of reports will be determined by the COR. The Contractor shall download this information from Maximo and provide this to the Government by electronic means such as EXCEL spreadsheets.

The Contractor shall ensure that all of the data fields described in the above sections are consistently and accurately populated to ensure that reporting is accurate.

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-12. FINANCIAL REPORTING (533) REQUIREMENTS**

**C-12.1 533 Reporting.** The Contractor shall submit monthly financial reports on NASA Forms 533 in accordance with the instructions on the reverse side of the form, and as published in the NASA Policy Guideline NPG 9501.2, see [Section J Attachment G](#), “NASA Contractor Financial Management Reporting. The Contractor shall, by the 15<sup>th</sup> of each month, provide to the COR the previous month’s financial 533 report. The 533 shall contain the following information in the specified format.

**C-12.1.1 Major Sections**

**Section 1 Overall Contract Summary**

**Section 2. Test Service Pool Summary**

Subsection 1.

Operations Costs

Subsection 2.

Preventative Maintenance Costs

**Section 3. Functional Cost Summary**

Subsection 1.

Maintenance Cost

**Section 4. Scheduled Work Cost Summary**

Subsection 1.

Individual SW Open Jobs Cost

**Section 5 CLIN 1 PSO**

Subsection 1.

Preventive Maintenance

Subsection 2

In-Service Inspections

Subsection 3

Functional Support

**Section 6 CLIN 2 CRYO**

Subsection 1.

Preventive Maintenance

Subsection 2

In-Service Inspections

Subsection 3

Functional Support

**Section 4 CLIN 3 Discrete Tasks PSO**

Subsection 1

Discrete Task Summary

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

Subsection 2

Individual Discrete Task Orders

**C-13. REPORTS AND DELIVERABLES**

**C-13.1. Technical Reports.** A summary of all technical reports, schedules, and other documents that the Contractor shall submit to the COR is provided below. This list is an addition to any administrative reports otherwise specified in the contract.

**Approval:** An (A) indicates that the data is furnished for approval by the Government

**Review:** An (R) indicates that the data is furnished for review by the Government.

Title	SOW Reference	A/R	Due Date (Calendar Days)
Overall written assessment of the CMMS	1.7.2	R	Within 30 days of Contract Start Date
CMMS Task Completion	1.7.2	R	7 Days after Task Completion
Annual Maintenance Shutdown Work Schedule	1.12	A	30 Days before the beginning of the Annual Maintenance Shutdown
Minor Maintenance Shutdowns			15 days prior to beginning of minor shutdowns
Daily Run Report	3.1.4.1 3.1.7.3	R	Daily (on or before 8 am of the subsequent day)
Annual Update of CP-DCS Operations Procedures & Check Sheets	3.1.7.1	R	60 days after Contract Start Date, then annually on every September 1 <sup>st</sup>
Condition Based Monitoring	3.2.4	R	Monthly
Monthly PM Work Schedule	3.2.6.1	R	Monthly, 10 days before the beginning of each month
Annual Service Agreement Status	3.2.14.1	A	Due January 15 <sup>th</sup> of each Contract Year
Site specific HASP Discrete Tasks	3.3.1.6	A	As Required
Implementation Request Cost Estimates	3.3.1.7	A	15 Days after Contractor receipt of the IR
Implementation Request Completion Report	3.3.1.8	R	30 Days after the completion of an IR
Red Line Drawing Updates	3.3.2	A	15 Days after the completion of a task 15 Days before Contract End Date
Update Operations Procedures	3.3.2.2	A	After completion of Implementation Request
Test Plans	3.3.4.1	A	As Stated in Implementation Request

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

<b>Title</b>	<b>SOW Reference</b>	<b>A/R</b>	<b>Due Date (Calendar Days)</b>
Test Reports	3.3.4.2	R	As Stated in Implementation Request
Training Records	3.3.5.1	R	As Requested
Contractor Licensing Listing	3.4.2	R	7 Days after Contract Start Date, then as needed
Critical Personnel Listing for Emergencies	3.4.3	R	3 Days after Contract Start Date, then as needed
Training Documentation	3.4.4 3.4.5 (1), (2)	R	30 Days after Contract Start date, then Annually by January 15 <sup>th</sup> or as Required
Status of any work assignment	4.1.1	R	60 Minutes after requested by the COR
Facility Change Requests Service Requests	4.1.2	R	As required
Technical Reference Library Status Report	4.1.4	R	Annually before the first Friday in September of each year
Quality Control Procedures	5.3	A	30 Days after Contract Start Date
Health & Safety Plan	7.2	A	60 Days after Contract Award Date
Accident Reports	7.4	R	As Required
Qualified LO/TO Personnel Roles and Responsibilities	7.6.1	R	15 Days after Contract Start Date, then as requested by the COR
System Outages Notification/Area Clearance Requests	7.9	A	5 days prior to Outage, as required
Customer Notification, Security, and Facility Access	7.9.1	R	5 days prior to Outage, as required
Area Clearances	7.9.2	A	As Required
Safety Permit Status Update	7.11	R	14 Days after Contract Start Date
Safety Permit Renewal Documentation	7.11.1	A	As Required
Financial Reports	8.1	A	Monthly (by the 15 <sup>th</sup> of each month)
Technical Progress Reports	11.2	R	Monthly (by the 15 <sup>th</sup> of each month)
Weekly Staffing Report	11.3	R	Weekly (on or before 8 am of the first working day of the week)
Miscellaneous Reports	11.5	R	As Required
Area Supervisors, Authorized employees, etc	7.6.1	R	Within 15 days after Contract Start Date
Joint Inventory Listing	9.2	R	30 Days after Contract Start Date



**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

<b>Title</b>	<b>SOW Reference</b>	<b>A/R</b>	<b>Due Date (Calendar Days)</b>
(includes facilities, equipment, tools and materials)			
General Inventory Report	9.3.1	R	Quarterly, by the 15 <sup>th</sup> of September, December, March & June
Contractor Acquired Material	10.2 10.2.3	R	Quarterly, 15 <sup>th</sup> of September, December, March & June & 15 Days before Contract End Date
Critical Spare Parts Inventory Report	10.3	R	15 Day after Contract Start Date then Quarterly by the 15 <sup>th</sup> of September, December, March & June
Material Certificates, Descriptive Data & Samples	10.6	R	Upon Request
Risk Management Plan	11.4	A	Within 30 days after Contract Award and annually thereafter
Affirmative Action Plan (AAP)	11.7.1	R	Within 9 months of the contract start date
Workforce Analysis Report	11.7.2	R	Within 30 days of the contract start date
Recruitment and Hiring Plan	11.7.3	R	Within 30 days of the contract start date and an update of this plan by the 30 <sup>th</sup> day of each evaluation period
Educational Outreach Plan (EOP)	11.7.4	R	By the 30 <sup>th</sup> day of each evaluation period
Educational Outreach Plan (EOP) Accomplishment	11.7.4.1	R	2 weeks after the closing of the evaluation period
<b>Title</b>	<b>SOW Reference</b>	<b>A/R</b>	<b>Due Date</b>
HASP	1.7	A	14 days prior to Start Date
System Outages Notification/Area Clearance Requests	1.9	A	10 days prior to Outage, as required
Customer Notification, Security, and Facility Access	1.9.1.1	R	3 days prior to Outage, as required
Critical Personnel Listing	1.10.3	A	7 days prior to Start Date Updates within 3 days as required
Contractor Licensing, etc.	1.10.4	R	Upon Request
Safety Permit Renewal Documentation and Support.	1.10.5	R	As Required
Training Plan	1.10.7	R	As Required

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

<b>Title</b>	<b>SOW Reference</b>	<b>A/R</b>	<b>Due Date (Calendar Days)</b>
Status of any assigned work	1.14	A	As Required
Inventory Listing (includes facilities, equipment, tools and materials)	3.1.1	R	Award + 30 days
Material Certificates, Descriptive Data & Samples	4.5	R	Upon Request
CMMS Data Assessment	5.2.3	R	Award + 90 days
Annual Work Schedules Initial Schedule Option Renewal Schedules	5.4.1	R	Award + 30 days Option Effective Date
Other Work Schedules	5.4.2	R	Upon Request
Annual Maintenance Shutdown Work Schedule	5.4.3	R	60 days prior to beginning of Annual Shutdown 14 days prior to beginning of minor shutdowns
Operations Plan	5.5	R	Award + 30 days
Technical Progress Reports	5.6.1	R	Monthly (within 5 days of the subsequent month)
Daily Run Report	5.6.2	R	Daily (on or before 8 am of the subsequent day)
Weekly Staffing Report	5.6.3	R	Weekly (on or before 8 am of the first working day of the week)
Financial Reports	5.6.4	R	Monthly (within 5 days of the subsequent month)
Inventory Reports	5.6.5	R	Monthly (within 5 days of the subsequent month)
Miscellaneous Reports	5.6.6	R	Upon Request
Red-Lined Prints	5.8.1	A	Government Approval + 3 days
Final Drawings	5.8.1	A	Red-Line approval + 30 days, and 5 days prior to contract completion
Area Supervisors, Authorized employees, etc	6.8.1	R	Award + 10 days
Engineering Drawings and Manuals	7.2.2	R	As required, prior to installation
Installation and Test Schedules	7.5.2	A	As required, prior to installation
Test Plans	7.5.3.1	A	As specified in work order
Test Reports	7.5.3.2	R	Test event + 7 days, as required

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

<b>Title</b>	<b>SOW Reference</b>	<b>A/R</b>	<b>Due Date (Calendar Days)</b>
Reliability Centered Maintenance Plan  Draft #1 Draft #2 Final Plan	8.7	A	 Award date + 60 days Award date + 120 days Award date + 240 days

Preliminary Draft

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

**C-14. ACRONYMS AND DESCRIPTION**

Name	Description
A	Annual – Services performed once during each 12-month period of the contract at intervals of 335 to 395 days.
ABS	Absolute
AEF	Atmospheric Exhaust Fan
AFP	Authorized Field Personnel (AFP)
ANSI	American National Standards Institution
ASME	American Society of Mechanical Engineer
AWS	Annual Work Schedule
BA	Biennial – Services performed six (6) times each 12-month period of the contract intervals of 58 to 63 days.
BRC	Bridge Controller
BW	Biweekly – Services performed 26 times during each 12- month period of the contract at intervals of 13 to 15 days
CADS	Central Air Distribution System
CADPS	Central Air Distribution Piping System
CAEB	Central Air Equipment Building
CAM	Contractor Acquired Materials
CCB	Central Control Building
CCC	Compressor Controls Corporation
CCD	Configuration Control Database
CFR	Codified Federal Regulations
CMMS	Computerized Maintenance Management System
CO	Contracting Officer
COR	Contracting Officer's Representative
CPSDC	Central Process System Distributed Control
CPSDC-DB	Central Process System Distributed Control - Database
CPS	Central Process System
CROM	Central-Process Recertification, Operation and Maintenance
CT	Cooling Towers
CTW	Cooling Tower Water
D	Daily – Services performed 261 times during each 12-month period of the contract, once each day, Monday through Friday, including holidays unless otherwise noted
DBF	Data Base File
DCS	Distributive Control System
DEC	Digital Equipment Corporation
DOS	Disk Operating System
ED	Electrical Dispatcher
EDM	Engineering Data Manager

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

Name	Description
EPA	Environmental Protection Agency
EPL	Electric Power Laboratory
ERB	Engine Research Building
EWS	Engineering Workstation
FAR	Federal Acquisition Regulations
FCO	Field Console Operator (FCO)
FCR	Facility Change Request
FDI	Foreign Device Interface
FEO	Field Equipment Operator
FLSA	Federal Labor Standards Act
FMEA	Failure Mode and Effect Analysis
GFE	Government Furnished Equipment
GFF	Government Furnished Facilities
GFM	Government Furnished Material
GMI	Glenn Management Instructions
GRC	Glenn Research Center
I&R	Inspection and Recertification
I/O	Input/Output
IDE	Integrated Desktop Environment
IRT	Icing Research Tunnel
ISI	In-Service Inspections
IT	Information Technology
LAN	Local Area Network
LOTO	Lockout/Tagout
M	Monthly – Services performed 12 times during each 12-month period of the contract at intervals of 28 to 32 days.
M&R	Maintenance and Repair
MADR	Maximum Allowable Defect Rate
MAXIMO	Current CMMS database program used at GRC
MODP	Mechanical Operator Duplex Panel
NASA	National Aeronautics and Space Administration
NEC	National Electric Code
NEMS	NASA Equipment Management System
NHB	NASA Handbook
NIS/NPM	Network Internet Slaves/Network Processing Modules
NPD	NASA Policy Directive
OCMR	Operation Corrective Maintenance and Repair
ODM	Open Data Manager
OIS	Operator Interface Station
OSHA	Occupational Safety and Health Administration

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

Name	Description
PBS	Plum Brook Station
PCU	Process Control Units
PGM	Program Maintenance
PID	Proportional Integral Derivative
PLC	Programmable Logic Controllers
PM	Preventative Maintenance
PPE	Personal Protective Equipment
PRS	Performance Requirements Summary
PSD	Pressure Systems Database
PSPV	Pressure Systems and Pressure Vessels
PT&I	Predictive Testing and Inspections
PWS	Performance Work Statement
Q	Quarterly – Services performed four (4) times during each 12-month period of the contract at intervals of 80 to 100 days.
QA	Quality Assurance
QAE	Quality Assurance Evaluator
QASP	Quality Assurance Surveillance Program
QC	Quality Control
RCM	Reliability Centered Maintenance
RFP	Request for Proposal
RTF	Run-to-Failure
SA	Semi-annual – Services performed twice during each 12-month period of the contract at intervals of 160 to 200 days
SAC	Service Air Compressor
SAD	Service Air Drier
SCCB	Software Configuration Control Board
SCO	Senior Console Operator
SDB	System Data Books
SLDG	Software Logging Database Graphics
SMACS	Synchronized Motor Auxiliary Control System
SOW	Statement of Work
SSA	Source Selection Authority
SSR	Special Service Request
SW	Scheduled Work
TD	Trane Dehydrator
TIN	Taxpayer Identification Number
TRL	Technical Research Library
UPS	Uninterruptible Power Supply
VF	Variable Frequency

**CENTRAL-PROCESS RECERTIFICATION, OPERATIONS AND MAINTENANCE (CROM)  
PRELIMINARY DRAFT STATEMENT OF WORK**

Name	Description
VMS	Virtual Memory System
W	Weekly – Services performed 52 times during each 12-month period of the contract at intervals of 6 to 8 days
WDPF	Westinghouse Distributive Processing Family
WWS	Weekly Work Schedule
100 HRS	PM to be performed every 100 hours of operations
300 HRS	PM to be performed every 300 hours of operations

[END OF SECTION]

Preliminary Draft